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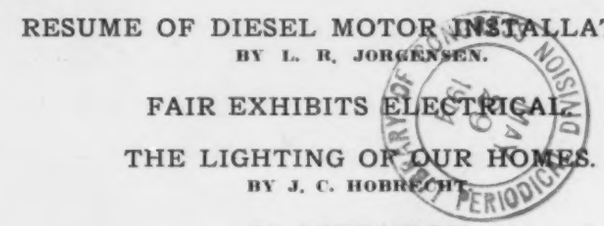

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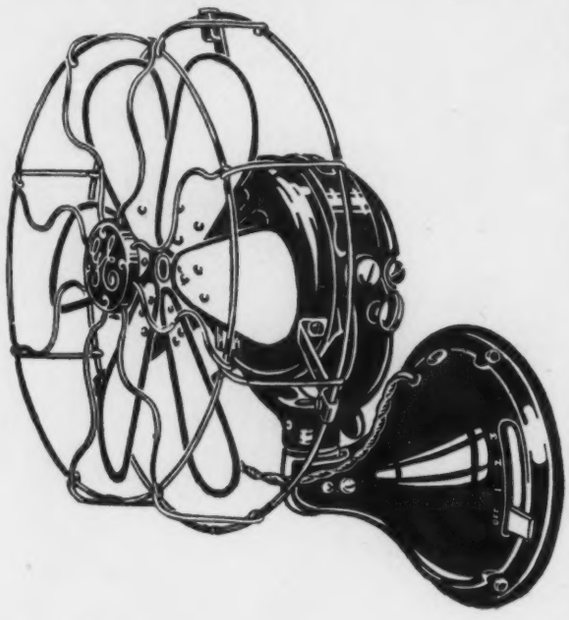

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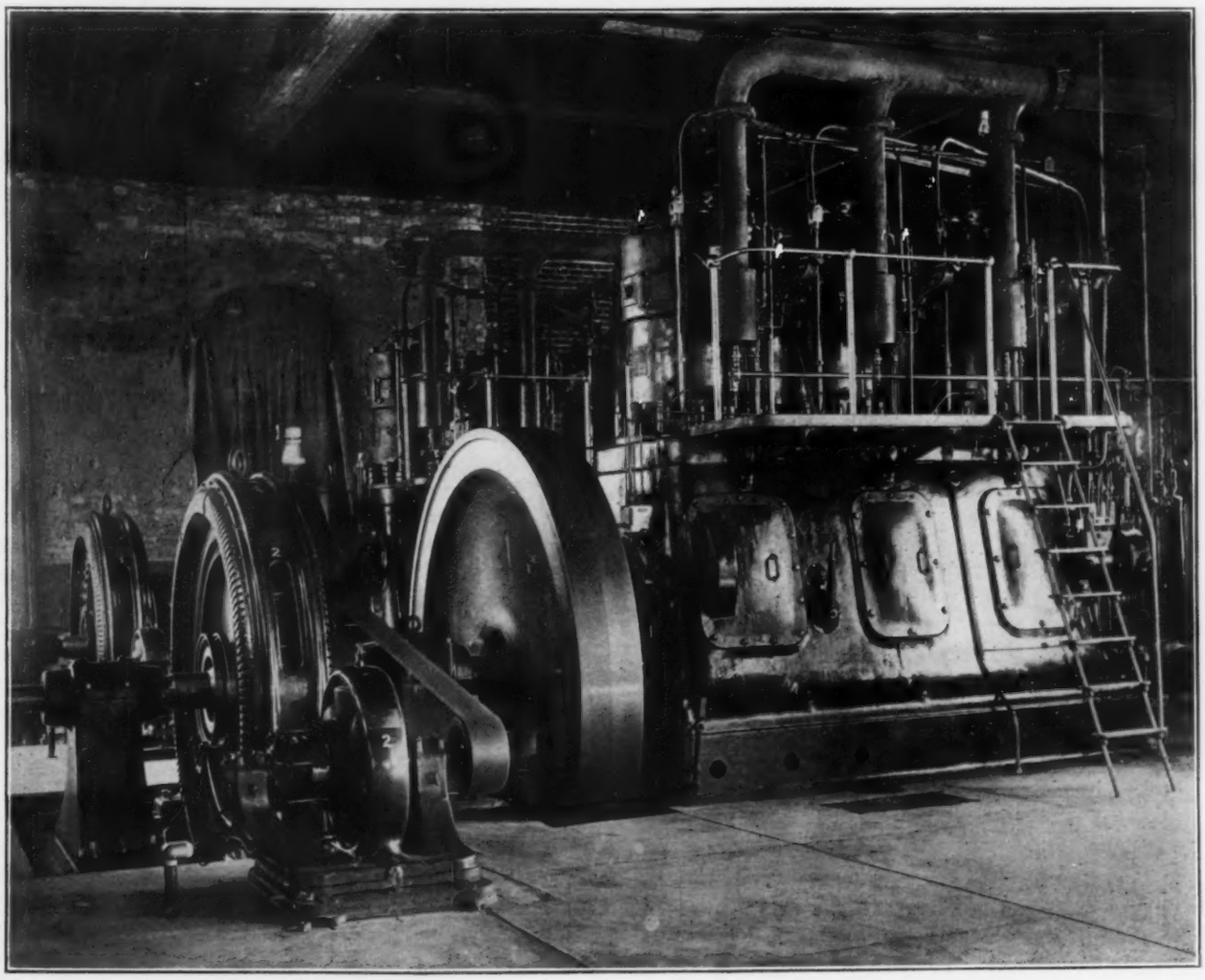
RESUMÉ OF DIESEL MOTOR INSTALLATIONS

BY L. R. JORGENSEN.

(This article covers the possibilities and present limitations of the Diesel motor. The period over which development has occurred is stated, also the fundamental principles of operation upon which efficiency is based; design is then discussed with reference to particular installations and comparative data given. This paper was presented before San Francisco Section, A. I. E. E., on May 22, 1914, by Mr. Jorgensen, who is designing engineer with F. G. Baum & Company, San Francisco.—The Editors.)

To the electrical engineer the development of the Diesel motor is of interest, inasmuch as it may prove to be a competitor of the steam turbine for large central station work in the future. It is not the fault of the principles upon which this motor works that it is not already delivering the goods there, but because with present oil prices it does not pay and also on account of the inability to produce materials that will stand the high temperature without cracking. This material may or may not be produced in the future, but why should it not? It has been shown in practice that cast iron cylinders will stand the required high temperature at which it is economical to work. For large size cylinders, however, it is not possible to



Two 225 h.p. Busch-Sulzer Bros. Diesel Engines Direct Connected to A. C. Generators.

conduct the heat away fast enough to avoid a dangerous rise in temperature, and therefore the cylinders cannot be made very large. For a large power output many cylinders would therefore be required. This is the main drawback to this type of engine at the present time.

Diesel constructed his first experimental engine at Augsburg, Germany, in 1893, and his first reliable engine in 1897. Progress was slow. Some of the first and most important improvements were the additions of the air spraying pump and the cylinder water

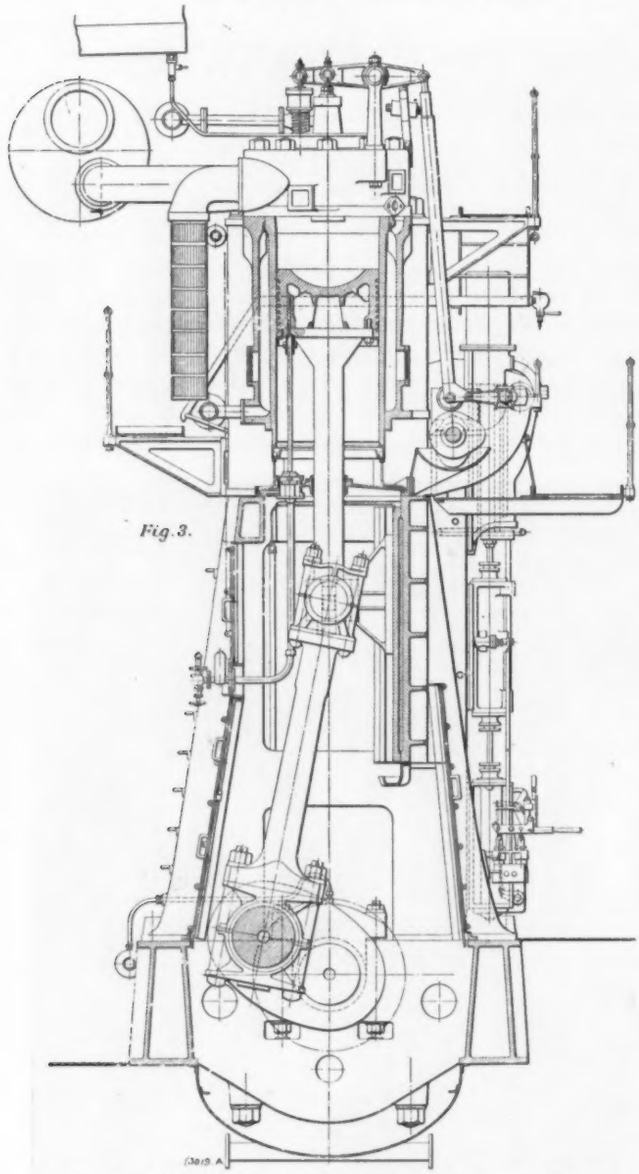
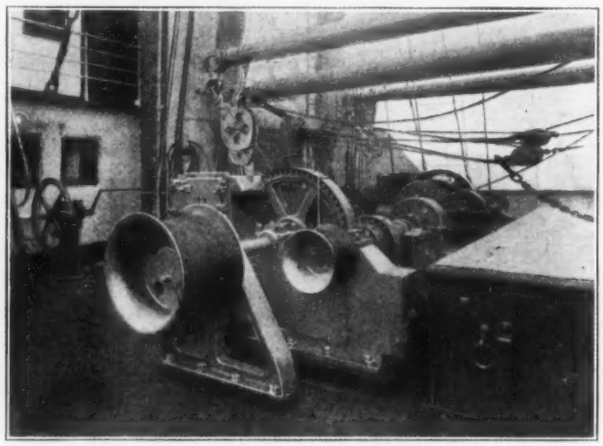


Fig. 3.

Cross Section of 2100 h.p. Diesel Engine Installed in Motor-Ship "Fionia."

jackets. It was found that atomizing the oil as it was injected into the cylinder assisted combustion materially, thereby increasing the efficiency. Good commercial engines have been on the market, especially in Germany, since 1900, and in the last few years the yearly production has increased immensely all over Europe. Mr. Diesel has often stated that his principle is especially suitable for an engine using two strokes to complete the cycle, because the scavenging is not done with a fuel air mixture, but with pure air, so that not only premature ignition, but also fuel losses, are avoided, and the scavenging can be done very effectively. So far, however, the four-cycle principle has come into most extensive use. This principle works as follows:

During the downstroke of the piston, atmospheric air is sucked into the cylinder and on the return stroke this air is compressed to between 500 and 600 lb. per sq. in. The temperature (about 1000 degrees F.) due to this compression is high enough to ignite the atomized oil, which is forced into the cylinder at the end of the compression stroke. This oil burns slowly



Electric-Driven Hoist on Motor-Ship "Siam."

in the cylinder, keeping the pressure constant between 500 and 600 lb. per sq. in. until the admission valve closes and the expansion commences. At the end of the stroke the exhaust valve opens and during the return stroke all gases are expelled from the cylinder and the cycle is completed. The four-stroke cycle engine has a better combustion and 15 to 20 per cent less fuel consumption than the two-stroke cycle engine. Some engineers are doubtful whether this supremacy will last much longer, and think the two-stroke cycle engine with its smaller cylinders will come into favor soon. At several large German works experiments are being made on double-acting two-cycle engines where as high as 2500 h.p. per cylinder has been obtained. At the present time, however, such large output per cylinder is not a commercial reality.

To determine the dimensions of any size engine the value of the most economical mean effective pressure is of particular interest to the designer. To illustrate the significance of this factor let $\mathbf{p_m}$ = mean effective pressure, **A** = area of piston, **S** = piston speed. Then indicated power = $\mathbf{p_m A S}$.

It follows that if the piston speed **S** is selected, the product $\mathbf{p_m A}$ is a constant for a given power developed. Thus the higher the value of $\mathbf{p_m}$ the smaller will be the necessary value of **A**, and therefore the smaller the cost of the engine. Therefore, the designer would desire to adopt the highest possible mean effective pressure at normal load of the engine, consistent with reliability and with the fulfilling of any guarantee as to capacity for overload without an excessive sacrifice of economy. Actual test has shown that the economy varies but little for $\mathbf{p_m}$ — between 80 lb. and 110 lb. per sq. in. It is not desirable to attempt to obtain a mean effective pressure beyond 110 lb. per sq. in., as the

excess of air for combustion in the cylinder is then comparatively small and sufficient cooling of large cylinders and valves becomes a difficult problem. The following approximate calculations illustrate the magnitude of the excess air for combustion:

Cylinder diameter, 12 in.; stroke, 18.25 in.; p_m (mean effective pressure) = 110 lb. per sq. in.; r. p. m., 200; indicated h.p., 57.3; brake h.p., about 40; oil used per cycle, 0.00314 lb. (* "The Engineer," April 11, 1913); air temperature at the beginning of compression, say 120° F.; air theoretically necessary per pound of oil, about 14.6 lb.; volume of air per pound of air at 120° F. and atmospheric pressure, 14.6 cu. ft.; volume swept by piston per stroke, 1.2 cu. ft.; weight of air taken in per cycle $\frac{1.2}{14.6} = 0.082$ lb.

Then ratio

$$\frac{\text{air supplied}}{\text{air theoretically necessary}} = \frac{0.082}{0.00314 \times 14.6} = 1.79$$

This ratio would be unity when enough oil was supplied to raise p_m to 140 lb., assuming that all the oil would find all the air there was present. From this it follows that the probable highest limit of mean effective pressure is below 140 lb. per sq. in. on the Diesel cycle. When for maximum power p_m is chosen

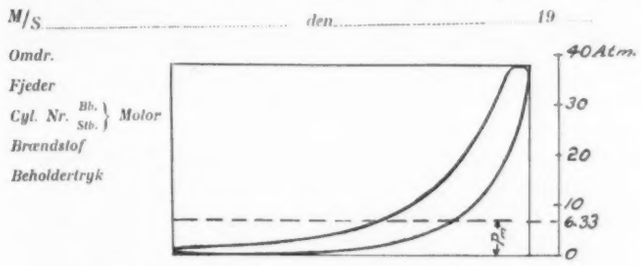


Diagram of Diesel Engine Cylinder of "Siam" During Normal Operation.

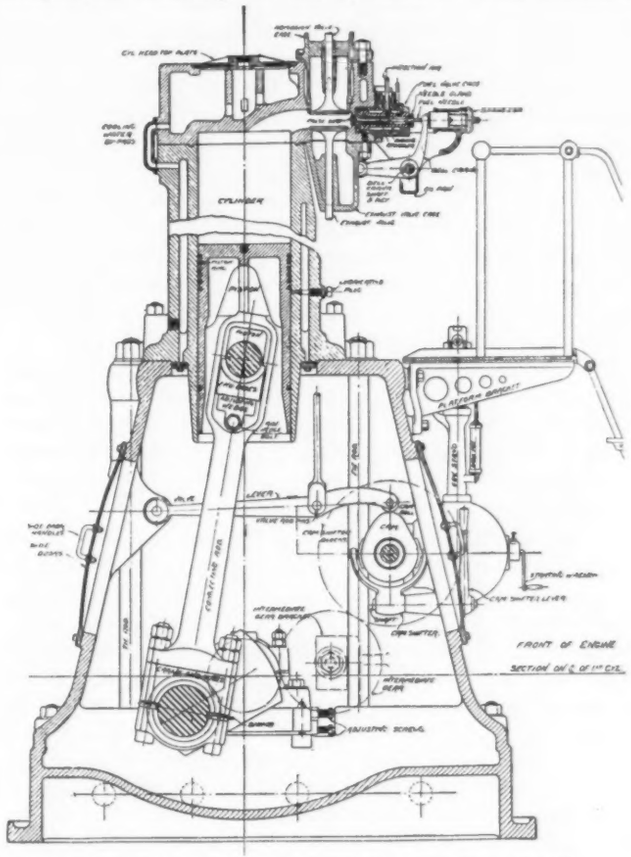
110 lb. per sq. in., the engine will work with a high efficiency over a wide range of power output below this maximum. It can develop more power than this assumed maximum (up to that corresponding $p_m = 140$ lb. per sq. in.), but not so economical.

At present the Diesel engine is in successful operation in many central stations of medium size abroad, and in many industrial plants. It is used to quite an extent for ship propulsion, and in this particular field it is very promising. During the early part of January the largest vessel so far equipped with Diesel engines unloaded freight in the San Francisco harbor, and several local engineers inspected the new machinery. The general opinion concerning the success of this kind of prime mover was favorable. Among those local engineers who made the trip across the bay in the engine room of the Siam no one afterward doubted the maneuvering abilities and reliability of these engines.

The Siam belongs to the East Asiatic Steamship Company of Copenhagen, and was built by Burmeister & Wain of Copenhagen. It is 410 ft. long, 55 ft. wide and the draft is 27½ ft. when carrying 9400 tons of cargo. Each of its two main engines are provided with eight cylinders 590 millimeters (23.23 in.) in diameter and 800 millimeters (31.496 in.) stroke. In good weather this ship makes 12 knots per hour, and in bad weather 10 knots per hour at an engine speed of 125 to 130 r.p.m. Each engine is of 1600 indicated horsepower capacity, and looks much the same as an ordinary steam engine in all its parts except the valve gear.

Each cylinder is provided with one exhaust and one suction valve exactly alike and mounted symmetrically with respect to the centerline. Between these two the starting air valve and the oil spray injection valves are located. The starting air valve is only in use during about two revolutions of the engine, and is cut out automatically during the normal operation of the engine.

In the space just back of the oil valve, the oil is mixed with air in much the same way as steam and oil are mixed for oil burning purposes under boilers. When the valve opens the mixture is injected into the cylinders under a pressure of about 60 atmospheres against the maximum compression pressure of 38 atmospheres existing in the cylinders. The mixture



Cross-Section Through Busch-Sulzer Bros. Diesel Engine.

now burns, keeping the pressure constant at 38 atmospheres until the oil valve closes and the expansion commences. In Fig. 1 is shown a diagram taken from one of the engine cylinders of the Siam during normal operation. The mean effective pressure, as measured, is 6.333 atmospheres, or 93 lb. per sq. in. Keeping in mind that the piston gets an impulse only every other time it is going down, the indicated horsepower from from one cylinder can be found thus:

$$93 \times \frac{\pi \times 23.23^2}{4} \times \frac{31.496}{12 \times 550} \times \frac{127}{60 \times 2} = 195 \text{ h. p.}$$

Each cylinder is supposed to normally indicate 200 h.p. It may be that the engine is supposed to

make more than 127 r.p,m., or that the card in Fig. 1 is not quite a normal one. It is seen that, if the normal indicated output of one cylinder is about 200 h.p., with $p_m = 93$ lb. per sq. in., this engine has a large overload capacity, as it is possible to raise p_m to 140 lb. per sq. in. by injecting more oil. This fact is also taken advantage of when starting the engines; enough oil can be injected to make them come to overspeed in an instant.

When the signal for starting is received in the engine room a small turbine operated by compressed air at 20 atmospheres is started one way or the other. This moves the cam shaft lengthwise about 1½ in., whereby the proper cams for either forward or back operation comes into working. This consumes about 5 seconds time, but could probably be done faster if required. Then air at 20 atmospheres is admitted to the main cylinders and the engine begins to revolve. After making about two revolutions on air the oil is admitted and the air gradually cut out. The oil supply is rapidly increased and in about 5 seconds the engines are running at the rate of about 200 r.p.m. This speed is kept up for a short time only, and the operating lever is thrown back to normal position, at which position the engines work most efficiently. When the engines are stopped, the small air turbine is made to move the cam shaft in the middle position. This is done for two reasons: First, that as the engineers do not know whether the next order will be forward or back, they put the cam in such a position that it will take an equally long time to throw it either in the forward or back position; and secondly, when the cam shaft is set in the intermediate position a small device opens all the exhaust valves to free all the cylinders from whatever charge they may contain. This prevents any premature explosion that otherwise might accidentally take place when the engines were again started.

The oil pump for injecting the oil into the cylinders is connected to the main engine through a gear, there being one pump for each four cylinders. This pump is fed by gravity and raises the pressure to the usual injection pressure of 62 atmospheres, though this varies from 60 atmospheres to 100 atmospheres, depending upon the viscosity of the oil. At 100 atmospheres the safety valve blows, indicating that the oil is too thick to be forced through the spray openings of the valve. The amount of oil is regulated by keeping the "suction" valve open for a longer or shorter space of time. The amount of oil and the amount of air for atomizing this oil are changed together on the main engines in such a way that no air is being wasted, the pressure of this air being 60 atmospheres.

On the two auxiliary engines of 250 indicated horsepower each, the air supply is constant and the governor only varies the oil supply according to the load. These two auxiliary motors each drive a d.c. generator when the ship is lying still loading and unloading cargo (all the hoists are electrically driven), and a compressor when out at sea. This compressor raises the air pressure from atmosphere to 20 atmospheres, and sends the air into a large storage tank, or into another air compressor where the air pressure is raised to 60 atmospheres. This last compressor is connected directly to the propeller shaft and furnishes the air for atomizing the oil injected into the cylinders.

Of other important auxiliaries in the engine room on board the Siam, the most important are the electrically driven pumps for pumping the fuel oil from the different compartments in the double bottom of the ship up into two fuel oil tanks (each tank sufficient for a 12-hour run) located some 30 feet above the pump feeding the oil to the cylinders. This of course is to insure a gravity flow to this latter pump. Then there is also a small auxiliary compressor, and a small generating set for lights. A small oil burning boiler is also located in the engine room for making steam for heating purposes.

In the double bottom of the ship, and in other places that cannot be put to any use, 1250 tons of oil can be stored. As the ship uses 10 tons of oil per day when at sea, it is able to carry fuel enough for a 125-day run, or 33,000 nautical miles. A ship with this engine capacity would require 50 tons of coal, or 30 to 33 tons of oil a day if provided with steam engines and boilers. The Siam can carry 1000 tons more weight, and much more than 1000 tons by measurement, than a ship of similar displacement provided with steam engines.

If 10 tons of oil is used in 24 hours, then 833 lb. are used in one hour, and the consumption per indicated horsepower would be $\frac{833}{3200} = 0.26$ lb., assuming one of the auxiliary and the two main motors to indicate 3200 h.p. altogether. Per brake horsepower this consumption would be approximately 0.34 to 0.36 lb. No accurate tests have been made as to consumption per brake horsepower, as the average ship-owner does not care so much for such figures. He is, as a rule, more interested in knowing the consumption of coal or oil fuel per diem in connection with dead weight and speed maintained. These figures define the fuel bill, which he is anxious to keep as low as possible, so that his ship may make a favorable showing in comparison with his competitors.

An interesting practical test has been made with the British ship S. S. Conch. From a number of voyages of this ship with the boilers burning either coal (14,500 B.t.u.) or oil (19,000 B.t,u.) and the engines kept running as nearly as possible in the same condition as regards vacuum, revolutions, etc., it was found that the ship carrying a dead weight of about 7700 tons would use 22½ tons of oil per day against 32 to 33 tons of Welsh coal, or a mean saving by weight in fuel consumption of 33 per cent. As a direct consequence of this, it was found the ship carried 150 to 200 tons more cargo when burning oil under the boilers. The indicated horsepower in both cases was close to 1670, although on the average, perhaps less when using coal. With regard to the speed attained by the ship, it was found that this was much better maintained by the oil-fired steamer. This was mainly attributed to dispensing with the cleaning of fires, and also to the fact that in the tropics it is hard to maintain full pressures on the boilers using coal. In reality the ship made one knot more per hour when oil was used for firing than it did when using coal under the boilers.

In comparing the enormous advantages derivable from oil fuel in connection with Diesel engine ships

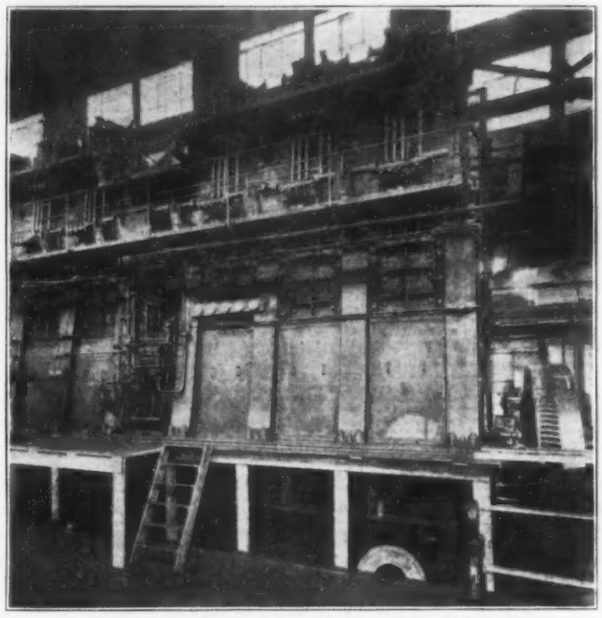
with the use of coal in ordinary steamers, the following figures obtained in actual working, the mean result of two years' running, may be found of interest.

Comparison between motor vessel Vulcanus, belonging to the Anglo-Saxon Petroleum Company, which commenced service in February, 1911, and a steamer of slightly less carrying capacity:

S. S. Vulcanus—	S. S. Sabine—
Length .....196 feet	200 feet
Breadth .....37 feet 9 inches	30 feet 6 inches
Draught .....12 feet 4½ inches	16 feet 9 inches
Dead weight carrying capacity..1235 tons	1269 tons
Displacement .....2080 tons	2290 tons
Mean speed.....8 knots	8 knots
Consumption per 24 hours.....2 tons oil	11 tons coal
Total No. staff and crew (European)....16	(Chinese) 30

The Burmeister & Wain Company of Copenhagen is at present building two large ships exactly alike, except that one is provided with a steam engine, and the other with Diesel motors. Comparative tests will be made by the owners of the ships, to find out to what degree it pays to remove the steam plant in existing steamers and put in Diesel motors.

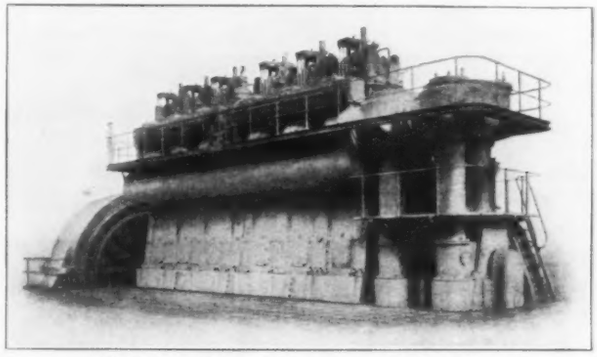
In February, 1912, the first Diesel ship, Selandia, left Copenhagen for East India. It had a carrying capacity of 7400 tons and its two motors indicated 2500 h.p. This was the trial boat. It worked admirably well, but it was found of advantage to make some changes in valve material and other changes. These changes decreased the oil consumption from 10 tons a day to about 8 tons.



One Set of Propelling Engines on "Fionia."

Two more ships like this first one were built for the East-Asiatic Steamship Company. Then a year later the Siam made its maiden voyage to Siam and back again, and then started on a trip around the world.

When the Siam arrived at San Francisco, it had motored 40,000 miles. During that time none of the main bearings had been scraped. This was, however, going to be done in the next harbor. The valves had been ground a few times while the ship was lying still in some harbor. This was done by the ship's own force. One valve broke at sea, being the only mishap on the 40,000-mile trip. It took 16 minutes to replace it. A valve does not break down without warning. It first becomes leaky, and for the purpose of detecting a leaky valve trial cocks are provided in proper places on the cylinders. When the leak becomes so bad that the



4000 h.p. Sulzer Diesel Two-Cycle Motor.

compression is lost, the power impulses of the corresponding cylinder is lost, and therefore the valve is changed as soon as the leak is detected, if possible.

The latest ship of the East Asiatic Steamship Company is the motor ship, the Fionia, a combination freight and passenger boat of nearly the same dimensions as the Siam, being 400 ft. long, 53 ft. breadth, and capable of carrying 7000 tons dead weight.

The propelling machinery, however, is larger, having an indicated horsepower capacity of 2100 for each of the two engines.

The advance of the art permitted this power to be generated in a six-cylinder engine, making it 350h.p. per cylinder, as against 200 h.p. for the Siam. The power plant in this ship occupies two-thirds of the space of a corresponding steam plant, and weighs 40 per cent less.

During the P. P. I. Exposition the Fionia is to run in passenger service between Copenhagen and San Francisco, but ordinarily it will run between Copenhagen and East India. At present it is on its maiden voyage to there.

The Fionia is expected to maintain a speed of a little above 14 knots. Its cylinder dimensions are as follows: Diameter, 740 m/m. (29.1 in.); stroke, 1100 m/m. (43.3 in.).

For cooling purposes the salt sea water is used. The propellers are normally making 100 r.p.m.

On land, where a motor only needs to be able to run in one direction, there is of course much less difficulty in successfully constructing them, and therefore much attention has not been paid to them in this article.

The accompanying view shows a 3000 kw. generator, driven by a 4000 h.p. two-cycle Diesel motor made by Sulzer Bros. in Switzerland. The view of the two 225 h.p. engines, made by the Busch Sulzer Bros. Diesel Engine Company, in St. Louis, is an American installation.

The standing of the Diesel engine in this country today is about the same as the standing of the steam turbine was twelve years ago. Whether it will be put into extensive use here will largely depend upon the desire of some large companies to take up its manufacture, which they will surely see fit to do, should fuel oil double in price.

SELLING ELECTRIC SERVICE

FAIR EXHIBITS ELECTRICAL.

(This is a description of an electrical exhibit for fairs as installed by the Pacific Light & Power Company and described in the Manager's Bulletin of that company. The apparatus exhibited is fully detailed and results showing the prospects secured also given.—The Editors.)

"Electricity on the Farm" was the feature of the Pacific Light & Power Company's exhibit at the Walla Walla County Fair and the Washington State Fair at North Yakima. The purpose of this exhibit was to show the many uses to which electricity could be applied on the farm, particularly emphasizing the use of a motor. To do this, nearly every type of farm machinery was installed and operated electrically, from incubators and milking machines down to the many household appliances. The exhibit was held in a large tent 30x100 ft. At the entrance of the tent were booths rented to local supply houses and dealers. In the center of the tent was the machinery exhibit and at the far end, a "modern farm house."

Night View of the Fair.

The Machinery Exhibit occupied a space in the center of the tent 18x35 ft. and railed off. Electrically driven farm machinery was set up, the illustrations showing the general arrangement of machines and method of installation.

The exhibits were as follows:

"Fork" Hay Hoist.—Manufactured by the Gilbert Hunt Company of Walla Walla, Wash. Double drum; price $275. This price only includes the hoist. The track, carriage and fork are separate and are handled by most implement houses. This was operated by a 3 h.p. General Electric motor, belted. Hay was actually hoisted from the ground and carried 25 ft. Then the fork was drawn back. All operated by one man seated on the hoist.

Roller Mill.—Manufactured by the Gilbert Hunt Company, Walla Walla, Wash. Operated by 1 h.p. General Electric motor. Machine operation—600 r.p.m. Oats were put through this mill, thus giving an actual demonstration.

Fanning Mill.— Walla Walla—handled by Tierney-Toner Company. North Yakima —handled by Yakima Implement Company. Machine operates at 70 r.p.m., driven from counter shaft. A fanning mill is used to clean all different kinds of grain and generally sells for about $40.

Apple Wiping Machine.—Manufactured by Enterprise Fruit Machine Company, Zillah, Wash. Sells for $110 at Zillah. Driven from counter shaft. Machine speed 125 r.p.m. (Requires 1 h.p. to operate.)

This machine is most satisfactory, and the fruit is cleaned thoroughly without any damage. At present there are about forty of these in use in the Yakima Valley and several at Hood River, Oregon. The Davidson Packing Company, foremost packers at Hood River, use this machine entirely for cleaning fruit. During the exhibit apples were run through the machine and a great deal of interest was created.

Milking Machine.—Manufactured by the Sharples Separator Company, branch office at Portland, Oregon. Operated by a 3 h.p. General Electric motor. A counter shaft was used to secure a reduction in the speed from 1800 r.p.m. to 80 r.p.m. required at the vacuum pump.

At Walla Walla, a Sharples Cream Separator was operated from this counter shaft by using a governor but at North Yakima, a direct drive was adopted.

Every afternoon at 4:30 during the Walla Walla exhibit, three cows were milked in an enclosure just outside of the main tent. Crowds were present every day.

Alfalfa Cutter.—Walla Walla—handled by Walla Walla Implement Company. Machine—"Ohio No. 9."

North Yakima —by Yakima Implement Company, Machine "Ohio No. 9."

Driven by 1 h.p. General Electric motor at 500 r.p.m.

Wood Saw.—Manufactured by Gilbert Hunt Company, Walla Walla, Wash. Belted to 1 h.p. General Electric motor, operated at 600 r.p.m.

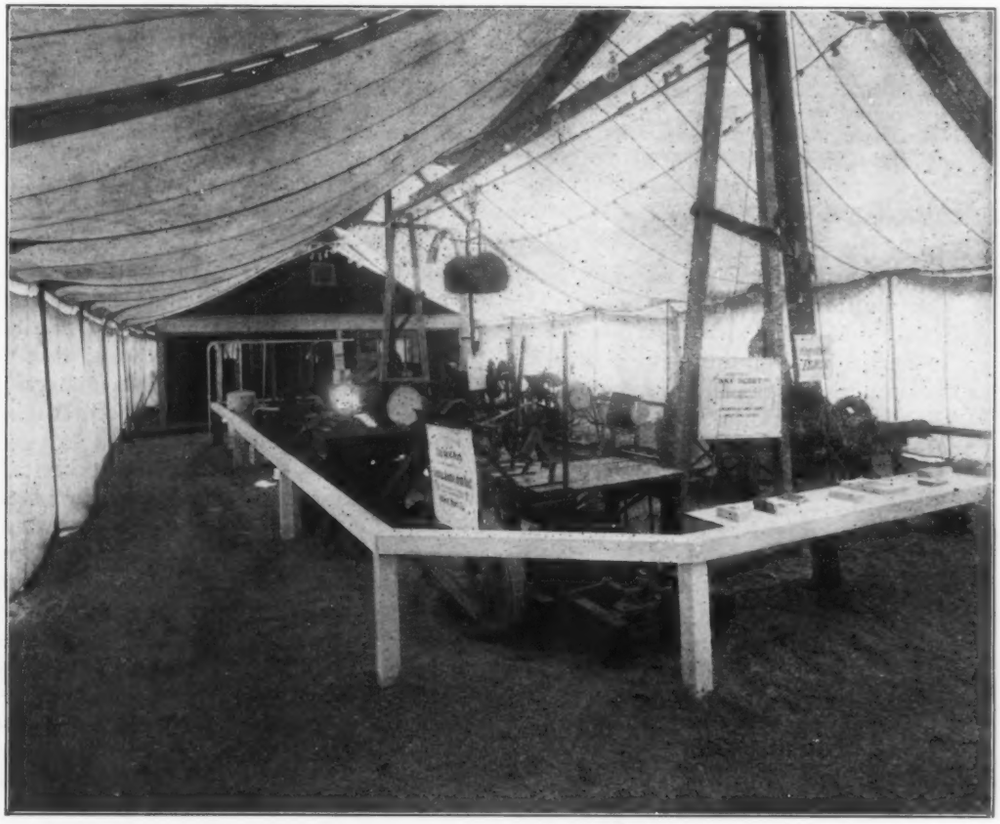
Ice Cream Freezer, Cider Press, Grind Stone, Barrel Churn.—All these machines were operated from countershaft, driven by 3 h.p. General Electric motor, 1200 r.p.m.—speed of counter shaft was 225 r.p.m.—speed of machines reduced to between 50-75 r.p.m.

Besides these, the apple wiping machine, fanning mill and power washing machine were driven by the same counter shaft. Great interest was created by this shaft drive and the women particularly were impressed at the convenience and labor saving value of a motor to drive these small machines commonly used around the farm house. The installation was especially an example of what a pump motor could be used for after the irrigation season.

The Cider Mill was also operated and cider served free to any person visiting the exhibit.

Ensilage Cutter.—Walla Walla—handled by the Walla Walla Implement Company. Type of machine—"Silberzahn."

North Yakima—handled by Yakima Implement Company; "Ohio No. 15," operated by 3 h.p. General Electric motor, belt drive.



Machinery Exhibit With "Modern Farm House" in Background.

The Modern Farm House.—At the rear of the tent "The Modern Farm House" stood as a model on an electric home. It consisted of two rooms, one a sitting room and the other a dining room, equipped throughout with electrical appliances and devices. Vacuum cleaner, electric fan, Copeman range and all other household appliances were demonstrated here. Coffee and toast were served and music helped to make it a pleasant rest room for "Fair" visitors.

At North Yakima particularly it was the popular resort and there was hardly an hour in the day when it was not filled.

At Walla Walla, the Valley Electric Supply & Fixture Company, and Prince Electric Company had booths, and in addition Freuler & Dyer showed the Perry Domestic Water System. The Ohio Vacuum Cleaner also had a booth and the Pacific Power & Light Company had additional space where a complete line of incubators were exhibited.

At North Yakima these exhibits of dealers were a great addition to the show. Not only did they bring out forcibly the value of the appliances through the capable sales force of these different concerns but they created an interest in the exhibit among the city people as well as the ranchers.

Beside the regular sales force of the company, representatives of the Westinghouse and General Electric Companies were present, giving most able assistance and their efforts were devoted not only to making sales and securing prospects but helped greatly in keeping up the enthusiasm which is necessary to make an exhibit of this nature successful.

It is always difficult to definitely state whether an advertising proposition such as this is successful or not, but as near as can be determined from the prospects secured and interest created, "Electricity on the Farm" exhibit this year did a lot of good.

At North Yakima, the following prospects were secured:

Incubator .....21 prospects
Domestic Water System..... 38 prospects

In addition, several plants were sold outright. (One installation is to be shipped to Switzerland and while this does not help to increase our business, still it shows the actual results brought to the exhibitor.)

Apple Wiping Machines.....90 prospects
Milking Machine .....10 sure sales and about 40 good prospects. The exhibit plant was sold.
Feed Mill and Ensilage Cutter.....60 prospects

The Ensilage Cutter particularly created interest. In the last year or so a large number of silos have been installed in the Walla Walla and Yakima Valleys and the increase in the stock industry and in the production of corn and alfalfa means that this class of business will grow very rapidly. All prospects were very much interested in the motor drive.

The supply houses secured about 50 prospects on appliances; "The modern farm house," nearly 30 prospects on Copeman Ranges, 25 on Vacuum Cleaners and 44 on general appliances.

Two lighting extensions were lined up, one for 16 customers and one 7 customers, both in the Selah District.

A careful and systematic "follow up" canvas is to be made of all prospects secured and actual business should result. The newspapers were most liberal in their comments of the exhibit and there is no question that "Electricity on the Farm" was one of the feature exhibits at both fairs. The night exhibit was most spectacular, as can be gathered from the illustration. The interior was also a flood of light. Something like 15 kw. was connected for illuminating purposes and about 20 kw. were utilized for power and experimental machines.

P. P. I. E. MACHINERY EXHIBITS

(It is required of all exhibits at the P. P. I. E. that they must be of educational value, and this is especially true of those pertaining to engineering and the allied arts. This new department of Journal service describing the various machinery exhibits, and here inaugurated, will have a dual interest and value, first as news of wide scope and interest, and secondly because of its educational import.—The Editors.)

A DIESEL ENGINE EXHIBIT FIRST.

The installation of the first exhibit at the Panama-Pacific International Exposition on Wednesday, May 27, will be the most important of the ceremonies of the Exposition to date and will mark the completion of the first stage of exposition building—the construction work and the commencement of the second phase of activity, the collection of exhibits from all parts of the world and the placing of them in their respective positions.

The first exhibit will be an immense 500 h.p. Diesel oil-burning engine and will be exhibited by the Busch-Sulzer Diesel Engine Company of St. Louis. The installation will cost $70,000 and will require six months to complete.

The nine principal exhibit palaces will be completed on May 25th and formally accepted by the Exposition from the contractors, and the installation of all classes of exhibits, save fine arts and horticulture, will commence immediately thereafter.

The company manufacturing the Diesel engine commenced the preparation of foundations for the mammoth exhibit on April 1. An appropriate celebration has been arranged by the Exposition for the installation ceremonies and Captain Asher Carter Baker, U. S. N. (retired), Director of Exhibits, will formally start the installation by pulling the lever of an electric pile-driver, which will sink the first pile to support the engine.

Addresses will be made by Captain Baker, Lieutenant George W. Danforth, U. S. N. (retired), Chief of the Department of Machinery, and W. S. Heger of the Busch-Sulzer Diesel Engine Company of St. Louis.

Lieutenant Commander C. H. Woodward, U. S. N., naval aid to President Chas. C. Moore, will deliver an address on "The Value of the Diesel Engine to the U. S. Navy."

That the first exhibit to be installed should be the most recent invention and one vital to California interests, as it will open a new field for the marketing of the crude oil, was deemed especially appropriate. There are several manufactures of the "Diesel" engine, this exhibitor, however, being the only one in the United States.

The ceremony will be held at two o'clock in the Palace of Machinery and will be attended by several hundred engineers of note from all parts of the country, and city and state officials.

U. S. STEEL CORPORATION EXHIBIT.

The announcement is made that the United States Steel Corporation and its subsidiary companies propose to have a comprehensive exhibit of its operations at the Panama-Pacific Exposition in San Francisco, 1915. It will begin with the ore fields and carry on an educational picture of the operation in ore mining, rail and water transportation, dock operations, coal, coke and pig iron production, steel manufacturing in its various lines, the processes of manufacturing of many of its subsidiary companies' products (including "National" tubular and allied products), also the manner in which its by-products, and the display of many of the uses in which its general products are employed, typifying the advancement in the uses of this country's resources.

In addition to the material exhibits, the corporation will exhibit, by moving pictures, its operations throughout all departments showing the ramifications of the processes of the corporation's operations. It is proposed as well, to set forth to the world the work which the United States Steel Corporation has done toward the social welfare of its employees and those depending upon them. Many forms of safety devices will be exhibited that have been conceived by the corporation officials and its employees and in the installation of which large sums have been, and are being expended by the corporation. In this social welfare department will also be shown the methods employed by the corporation in the aid and care for the injured and the welfare of employees' conditions at work and the benefits that are aimed to be afforded to employees at their work and in their surroundings. Also the voice that is given to the employees through their committees in bringing about these improved working conditions and the general plans of the corporation's methods.

OFFICIAL CLASSIFICATION OF EXHIBITS.

Machinery, listed under Department F. Group 85 is as follows:

Steam Generators and Motors Utilizing Steam. Accessory Appliances.

Class 449. Steam engines and steam turbines, portable, semi-portable and stationary; valve gear, governors, lubricating apparatus, and accessories attached.

Class 450. Boilers, stationary, marine, portable and semi-portable; boiler equipment, including furnaces, grate bars, smoke stacks, mechanical stokers, oil burners, oil and other fuel systems, mechanical flue and tube cleaners; forced and natural draft apparatus and equipment; fuel economizers, superheaters; boiler fittings; coal handlers and conveyors; ash handling systems and apparatus.

Note:—Agricultural and road making machinery is not included herewith.

Class 451. Appliances for handling and purifying feed water: feed pumps and injectors, feed water regulators, feed tanks; feed water heaters; chemical and mechanical purifiers, oil extractors, scale removing appliances and compounds; water softening compounds. (See Class 462.)

Class 452. Valve gear, governors and speed regulators for steam engines or turbines, not attached.

Class 453. Equipment for transmission and control of steam: steam piping and piping systems, including pipe, valves, fittings, steam hose, traps, separators and exhaust heads.

(To be continued.)

LIGHTING METHODS

THE LIGHTING OF OUR HOMES.

BY J. C. HOBRECHT.

(In this article which may be considered as introductory to others by the same author, some of the faults found in home lighting are mentioned and an appeal made to fixturemen to operate together in advocating good lighting—which includes lighting fixtures that harmonize with other decorations and furniture.—The Editors.)

The lighting of the home is the one phase of the lighting question where thought and energy expended in improving conditions will, perhaps, be of more real benefit to humanity than any other of the many problems confronting the illuminating engineer.

Many of the ills that human eyes are heir to, can no doubt be traced directly to the faulty illumination of the home. Perhaps in the very first moments that baby eyes are allowed to look upon some of our modern light sources the trouble is begun, to be aggravated later through bad illumination of study or play rooms, the family living rooms, or in fact most any or everywhere from cradle to grave. Faulty illumination enough is encountered to wreck all but the strongest eyes, and if we observe the number of even very young children wearing glasses, we, in the lighting business might ask ourselves whether we are guilty of some of this misery.

I think we will agree that at least a majority of homes are incorrectly lighted and many are simply atrocious. This statement holds true both from the artistic as well as the hygienic viewpoint.

The question then arises, who is responsible for this condition of affairs, and what is the remedy.

When we find a house that is poorly built, having seams and cracks, letting in the rain and weather, with poor ventilation, inconvenient arrangement of rooms, unsanitary plumbing, and an awkward, unsymmetrical exterior, on whom do we place the blame? Without hesitation, we blame the architect.

If a client should come to any reputable architect and ask him to design a house having all the faults just referred to, would he give the client what he asked for or would he refuse to build a house which violated all the principles of art and hygiene? I think the answer is obvious, yet the writer once asked the manager of a large lighting fixture house, why he placed on the market a certain fixture which was both horribly ugly and hopelessly inefficient, and listen to the answer he gave, "It sells." Does he not put himself exactly in the position of the architect who would knowingly and willingly design a house that would be an eyesore, uncomfortable, and a menace to the health of its occupants.

Anyone who will but give the lighting question a little study will see that those responsible for the creation of much of the lighting equipment of our houses are guilty of that very thing every day, and then they try to place the blame upon the unsuspecting laymen who of course does not and cannot be expected to know better.

We can thank the Illuminating Engineering Society for the great work it is doing to remedy this condition, but much remains to be done. To educate the general public directly would of course be attacking the problem from the wrong end, but those interested in the industry and making their living out of it, should, at least, study and be familiar with the principles of "good lighting," if not from a humanitarian or aesthetic viewpoint, then at least with a mercenary one, as it has been demonstrated time and again in many lines that the public is willing to pay for better things and will spend money freely for comfort and service, while the price of a mediocre article is usually paid grudgingly.

There is so much to be said upon this question that it will be impossible in an article of this kind to go deeply into detail. I will, however, enumerate a few of the faults commonly found in residence lighting with the hope to soon be able to give a more specific paper with more concrete examples and suggestions.

A short time ago the writer was in the drawing room of a very wealthy family. The room was most elegantly furnished. The work of an expert decorator was plainly visible in the hangings, wall coverings, pictures, and all the general furnishings but, Oh! the poor unfortunate lighting fixtures. They were about as much in harmony with their surroundings as the proverbial pig in the parlor. A ceiling fixture, a terrible example of the "Mission Craze" of a few years ago, was resplendent in a dressing of French Crystals and its bare tungsten lamps literally burned the eyes out of you, unless you shut them or kept your face to the wall. The writer tried the latter, as there, at least, he found brackets which in other surroundings he could have much admired, as they were really beautiful examples of the Louis XIV period, and the light of the low candle power carbon lamps was, at least, bearable, even if adding but little to the illumination of the room. This was evidently a case where the owner got what he selected, but what should we think of the man who sold it to him. The fixture salesman is often blamed for paying too much attention to the artistic and neglecting the practical side of the question, but in this case the salesman must have been devoid of any semblance of artistic feeling as well as brains.

Another example just the opposite. A dining room with dark tapestry walls and dark woodwork. An indirect fixture, made of composition of rather pleasing design, but hung much too low, throwing its light on an almost while ceiling, leaving the table dark in comparison and giving one rather the impression of being down in a well.

How easily in both of these cases might the lighting have been made a happy addition both to the artistic effect as well as adding to the comfortable occupancy of these rooms and, no doubt, the owners would have gladly accepted suggestions had they only received them. With a little study and thought on the part of the salesman, he could have made these rooms not only a joy to the owner but also a credit and a satisfaction to himself and would possibly have

brought more business to himself or his house in the future.

A doctor may prescribe good pills but if the druggist mixes in the wrong drugs, he will most likely do harm.

The illuminating engineer and the clever designer may work out many correct combinations of "good lighting" and "good taste," but if the fixtureman persists in handing the public the wrong thing, he injures not only the patient but himself and the whole industry as well. Here might be a good chance for that overworked but little heeded word "Co-operation."

If this article would but arouse a ripple of interest among my fellow (I came near saying conspirators) in the lighting business, I will be glad to follow it up and give time and lend whatever assistance I can to any effort to put the industry on a higher plane, to further the interests of correct illumination, especially on the Pacific Coast where but little concerted work has been done along this line.

IN LIGHTING, QUALITY COUNTS.

The effectiveness of lighting glassware is a new viewpoint which necessitates consideration of its fitness for the purpose for which sold.

The average fixture manufacturer or dealer tired long ago of the word "efficiency," for he found that customers' comments were not regarding resultant illumination, but were dependent upon the appeal of appearance to the purchaser's taste.

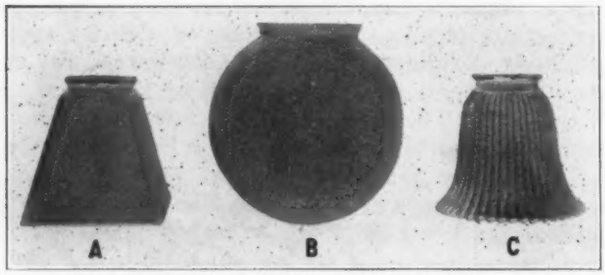


Fig. 1. Types of Glassware Used in Original. Installation.

Warm (lighted) glassware called forth comments such as "How pretty"; "That is pleasing"; "That is certainly cosy-looking," and so forth. The purchase was made accordingly.

Even now, it is rarely the case that lighting glassware is sold for what it will accomplish, but rather from this viewpoint of appearance.

Individual tastes of purchasers vary widely, taste being of course limited also by the cost of the glassware and the knowledge, or lack of it, on the part of the purchasers as regards the adaptability of the glassware chosen to the fixtures on which it is to be used and its relation to decorations and furnishings of the room in which it is to be installed.

Lighting installations, all other things being equal, should reflect the individuality of the owner of the home.

It would be unfair, however, to even suggest that the majority of home lighting installations actually do this, for there is in general a noticeable lack of harmony between the glassware and the fixture on which it is installed, between the size of the lamp and glassware, and in the general fitness of the ensemble.

There often exists also an unnecessarily low intensity of illumination.

This is due to changes in lamp styles and sizes without purchase of new glassware, and to changes in decoration of rooms and furnishings without consideration being given the lighting fixtures—the finial of the complete scheme of decoration.

Crystal, rough inside (C. R. I.) glassware was valuable only in passing. Though an excellent diffuser for carbon lamps with their yellowish glow, it is of but little value for reducing the brilliancy of present day Mazda lamps.

These are also required to be installed at greater mounting heights, and an assured and efficient control of the light flux is therefor essential. This does not obtain with the C. R. I. glassware, but is possible, and with increased effectiveness, in the lighting by use of more up-to-date lines, such as the ornamental and Sheffield designs in the so-called opal glassware and even with those designs now on the market, which totally enclose the lamp.

By the use of this glassware the brilliancy of the lamp is satisfactorily reduced, illumination values increased and the decorative value of the lighting scheme greatly enhanced.

In his paper on "Lighting of a Simple Home," presented by Mr. A. L. Powell before the Illuminating Engineering Society, he gave some interesting data regarding the C. R. I. glassware displaced, which he has tabulated as follows:

But three varieties of reflecting and diffusing media were used in the original installation. These are shown in Fig. 1, and the vertical distribution of light obtained from each one of them, using a 50-watt, 16.8 c.p. carbon lamp, is shown in Fig. 2.

(A) Square Rough Inside Crystal Glass Shade.

	Per cent.
Total lumens clear bare lamp	100
Total lumens lamp and reflector	86
Downward lumens lamp and reflector	51
Lumens in 0 to 60° zone lamp and reflector	28

(B) Rough Inside Crystal Ball.

	Per cent.
Total lumens clear bare lamp	100
Total lumens lamp and globe	90
Downward lumens lamp and globe	48
Lumens in 0 to 60° zone lamp and globe	24

(C) Imitation Prismatic Crystal Glass Shade.

	Per cent.
Total lumens clear bare lamp	100
Total lumens lamp and reflector	80
Downward lumens lamp and reflector	47
Lumens in 0 to 60° zone lamp and reflector	27

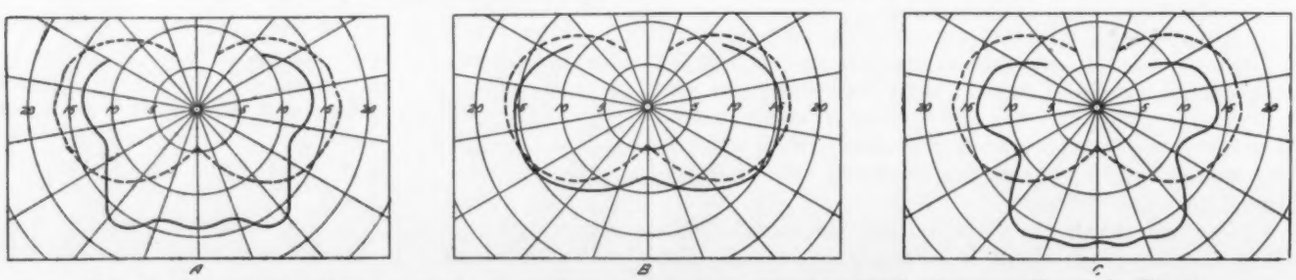


Fig. 2. Photometric Curves of 16.8 c.p., 50-Watt Carbon Lamp Equipped With Glassware Shown in Fig. 1.

From this it will be gathered that the average light flux in the useful zone (approximately 0°—60° in a direct lighting system) was only 25 per cent, which you will notice by comparison with photometric curves and data furnished you by manufacturers, is insignificant compared with that given by quality glassware. Withal the effectiveness of the installation will invariably be greater and quality sales resulting in satisfied customers will exert a strong influence upon improved business conditions in these lines.

It pays to co-operate also with those in occupations allied only remotely with the electrical industry.

Fixture men, for example, should work in co-operation with decorators, and lamp dealers would do well to discuss with purchasers the fitness of the lighting glassware, used by them, especially where it is known that a lamp of larger wattage than heretofore is being purchased.

In this way additional sales are made through service, and the increased business will be found much greater in proportion to the effort expended.

Quality sales should be mentioned in this connection, for they are then more readily made.

It will be found in general, that more artistic, more effective illumination can by but a little study be secured at a lower operating cost. Wherever you are able to demonstrate this—both by past performance and specific analysis—to your prospective customer's satisfaction, you will find that he will be readily converted to the business building truism and belief—In Lighting, Quality Counts.

Use this slogan in the interests of increased business and better business relations.

CO-OPERATION.

BY W. E. OLIVER.

(This paper was read by Mr. Oliver at a meeting of district managers of the Southern California Edison Company.—The Editors.)

The word Co-operation is defined by Webster as the act of operating together or joint operation.

In my opinion good, clean salesmanship is developed by the honest and truthful way in which the business is secured and the psychological moment will arrive according to schedule probably more often did we practice co-operation. Working together for mutual benefit. This is the whole trend of thought today. It means big, broad issues, and these must be met in a big, broad manner. We cannot all be presidents, but, by faithful service, honestly rendered, and a co-operative spirit, we should be able to fit ourselves to any position, either with our own company, or in other walks where our services may be in demand.

We are all salesmen, whether filling the position of meter reader, collector, bookkeeper, head of department, agent, clerk or secretary, for the reason that if we are not directly engaged in selling devices, we are selling that which with the united efforts of all, results in the satisfactory sale of our composite commodity, electric service.

The salesman should at all times co-operate with the customer, fellow employe and employer, and if these three are brought into harmony, you will find that the psychological moment has arrived.

The salesman, co-operating with his department, must find the ways and means of selling the commodity which the company has for disposal. This company, in selling its energy, renders a service which should be continuous, just as it is on our lines. That is, the salesman should keep in touch with the customer after the business is secured. You can do it by co-operation. The salesman should never consider a signed contract for energy or an agreement to take an appliance as a completed sale; rather, it is just the beginning and upon the salesman's representations, his care of the customer and the manner in which he handles the transaction and keeps in touch with all details, he either builds up or tears down the foundation of his company's success.

There should be a perfect understanding between the customer—future or otherwise—the salesman who represents the company and the head of the department as to every detail in question. This department should in turn be in close touch with the construction, connection and trouble departments as well as the accounting and business departments, so that work can be readily handled, complaints quickly and quietly taken care of, and the accounts properly turned over to the business department for their record.

To me, such a corporation as our own closely resembles an army on the field of battle. There must be generals and subordinate officers in order to faithfully carry out the designs of the commander-in-chief. Should one of the lines be weakened, the brunt of the battle must, of course, be borne by those who take a determined stand. So it is with such companies as our own, which is organized into different departments. If one department makes an error or falls down in their effort to create business, then it is absolutely necessary for the other departments to rally to its support; otherwise the whole fabric goes to pieces. The best phrase that I can think of at this time would be "Co-operation and Mutual Understanding." Where this exists between the employes of each department and the departments themselves, success is bound to be earned for the company, and this, of course, spells success for every employe. I believe, if we thoroughly understood the meaning of these two words we should be "boosters" and not "knockers," continually looking out for the welfare of everyone.

The courteous salesman will find it very difficult to satisfy a displeased customer unless that customer knows that the various parts of the company are really one big unit.

I believe we should all remember that, like some of the famous men of the prize ring, there are four things that never come back—the uttered word, the sped arrow, the past life and the neglected opportunity. This neglected opportunity may be your psychological moment, but it always brings us back to the same place—"Co-operation and Mutual Understanding."

Norwegian hydroelectric plant costs vary for construction from 100 to 200 crowns ($26.80 to $53.60) per h.p for large water plants and from 100 to 500 crowns ($26.80 to $134) per h.p. for small plants. The rate at which the power is sold to consumers varies from 30 crowns ($8.04) per h.p.-year for large enterprises up to 50 crowns ($13.40) for small ones on a 24 hours per day service.

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FOUNDED 1887 AS THE
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The Principle of Progress

I am a prophecy of the future and the power which initiates new methods; a creator and a destroyer; iconoclast and builder. I also re-create, construct and reconstruct. I am founded upon knowledge and projected into the future years. I am both negative and positive; a dream and a reality, for I am Imagination.

* * * * * *

The comforts and conveniences which we enjoy today are monuments to the efficacy of controlled imagination, not only on the part of contemporary thought and endeavor, but to the crowd of witnesses who have preceded our generation.

Though building upon a foundation of the known, this imagination, reaching beyond accepted bounds, is found to be the most important factor contributing to progress in all departments of life.

It is an unsleeping dream, in which knowledge, combined differently and given new forms, results in something almost entirely different; a difference which may change the old order and make possible the inauguration of the new.

But having dreamed this dream of imagination, care should be observed not to publish it, but those truths only which will stand the test of this new light of an aroused intelligence.

Therein lies the rub.

That which is fanciful, unreal and illusory, without foundation and uncontrolled, has fastened itself to this word so that by many its good intent is eclipsed by its possible wrong application and use. It is looked down upon as unworthy and thought to have no place in every-day business affairs. Given a bad name which it indeed finds hard to live down.

Yet memory, the value of which none will discount, makes it possible only to recall that which has been. It is left to the imagination to reconstruct the past so that it may be applicable to the present and enlarge the future.

It is not, therefore, to be feared, but encouraged, provided that it is made positive or constructive in action and not negatively destructive.

The right use of imagination results in profit.

Imagination does not necessarily reach conclusions which are fictitious, impracticable and misleading, and is not unreal except insofar as it is a thought and not a thing.

It has been described as the experimental laboratory of the thought factory, for here new thoughts are fashioned which relate to human progress.

Progress is realized imagination.

Six hundred years B. C., the effects of electricity as produced by rubbing amber had been noticed and recorded, but it is only during the past thirty years that the value of this force has been gauged and so developed that every phase of business has been facilitated and the burden eased.

Those who merely gather facts along the line of their employment are of no more use than an incomplete reference work on the same subject unless they use these thoughts also in conjunction with the faculty of imagination, for the collector of facts, unless he does this, is merely one of those whom Professor Huxley once called "the patient hodcarriers" of advancing thought and action.

Imagination is valuable because it makes reasoning progressive, fills with enthusiasm and stimulates to achievement. It sees the desirability of the end sought.

No man is a success who has not imagined himself a success, for no accomplishment can occur unless it is first imagined.

Imagery of speech is not, but imagery of ideas is certainly essential to success.

The expression of these newly created images of thought constitutes individuality, which, in turn, is the hall-mark of success.

By right use of the faculty of imagination you cultivate success. This is the principle of progress.

Premiums as Discount

Public utilities usually sell their product at a gross price which makes an allowance for the excess cost of collecting delinquent accounts. Public service commissions recognize this and in rate-making the price is so arranged that a discount is allowed for prompt payment. The resultant net price is the actual rate or selling price of the commodity which allows a reasonable rate of return to the utility.

Whether the difference between the gross and net price is sufficient to cover this item and the necessity for this to be the case, is another matter.

Those customers making prompt payment purchase service at the lowest possible price, while delinquent customers pay at least part of the additional cost incident to their delinquency.

This review of a self-evident situation is made in view of the fact that one of the meddling magazines which would suggest something new to the utility—a method of increasing sales which none had previously thought out—recommends that premiums be given in place of the present discount which is believed to be "given, in order to bring in the money."

It is true that if the public has something to lose through being dilatory, their actions are thereby accelerated, but this does not alter the fact that the utility loses nothing by "giving" the discount or the further fact that the discount is not "given," but "allowed."

It is the customer's before he receives it if he will but keep his part of the contract and pay promptly, so that the utility is saved the otherwise inevitable collection expense.

This suggestion of the magazine in mention, that premiums—coupons redeemable in merchandise—be given in place of the discount, in order to boost the demand, shows that those advocating this procedure do not fully grasp the situation, and further emphasizes the necessity for specialization in public utility publicity.

Such irritating articles need a reliable counter-irritant.

It has been pointed out on several occasions through these columns that the giving of premiums, because wrong in principle and pernicious in practice, is therefore undesirable, but it is even more so under the disguise of "something for nothing" to make the customer pay for appliances in order to "boost demand," whether he wants to or not.

Public utility service is based upon broader lines and more honest dealings with patrons.

There is the greater objection that the giving of premiums injures legitimate business.

To give is never better than selling, for trade and not charity is the basis of present-day existence.

And public utility enterprises are now realizing more than ever before the relationship of the parts to the whole and of the whole to the parts. The rights of the smallest dealer, for example, are now protected by the central stations, not because of the possible impudence of this Skye-terrier to the St. Bernard of the electrical business, but because the present status of the industry and progress both plead for and meet with co-operative effort.

So in this brief review of the "interfering parrot's naughty frame of mind," we again make an appeal for specialization in utility publicity and point to the advisability of recognizing and supporting those specialized publicists which technical and trade journals actually are.

The County Fair

At one time the happy hunting ground of the confidence-man, the thimble-rigger and trickster; a place for the rural simplisicus to be doubly fooled and fleeced; and for sales to be made upon the old Roman principle of trading—caveat emptor—a process of change is now occurring which promises to reverse this undesirable status of the county fair.

Merchants, manufacturers and others appreciating the value of direct contact with a people who, in residence, are widely scattered and difficult to reach, have seized upon the county fair opportunity for the presentation of their wares.

And because residents of rural districts have a past county fair experience which many would gladly hide, and, if possible, forget, it has become necessary for exhibitors to actually demonstrate the superiority of their wares in order to convert the passing interest in the novelty of the thing shown into a permanent interest and purchase. The result is that the county fair has become an educational as well as a pleasurable affair, with the undesirable features all forced into the background.

Governments the world over have grasped this situation and as a result of their educational effort stock is improving, average yields are made to increase and the farmer is becoming more prosperous as he adopts the demonstrated superior method.

Central stations who have taken advantage of this opening are repeating the experiment and wherever the value of electrical exhibits of this kind is questioned it is because the opportunity has not been fully advantaged or the actual results not carefully traced.

In this issue is given a description of an exhibit and the immediately traceable prospective business. If an exhibit is first made right and then followed up, and the farmer and his good wife not allowed to fall back into the former humdrum routine which they have learned to be unnecessary, county fair exhibits by central stations will prove themselves to be one of the most advantageous seasons at which to show the rural resident that it is better always to "Do It Electrically."

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Sylvester M. Baker of the Macbeth Evans Glass Company, is at Los Angeles.

George Cook, of the American Cross Arm Company, was at Seattle recently on business.

George Gray, of the Crouse-Hinds Company, was in Seattle last week and left for San Francisco on Friday.

Frank Quinn, of the Manhattan Electric Supply Company, San Francisco, was at Seattle recently.

J. I. Coldwell, manager Seattle office Western Electric Company was at San Francisco during the past week.

H. Hays, of the Mt. Whitney Power & Electric Company, Visalia, Cal., was at San Francisco during the past week.

Geo. A. Boomer, Pacific Coast representative Plume & Atwood Manufacturing Company, is at Los Angeles, Cal.

R. S. Kennedy, of the American Electrical Heater Company, who recently spent a week in Seattle, is now at Vancouver, B. C.

C. Loveday, electrical contractor of Santa Barbara, was at San Francisco during the past week and also visited Sacramento, Cal.

E. C. McBrerity, western travelling representative of the American Electric Heater Company, Detroit, Mich., is at San Francisco.

George Riddock, secretary Bauer Fixture Company, San Francisco, has been elected a member of the Illuminating Engineering Society.

Louis E. Degan has been appointed consulting engineer by the Los Angeles city council for the bureau of fire alarm and police telegraph.

Hal Lauritzen, manager Western Division Holophane Works of General Electric Company, has returned to San Francisco from Los Angeles.

Geo. N. Rooker, manager of the Northern Idaho & Montana Power Company, Sandpoint, Idaho, was elected president of the Sandpoint Commercial Club at a recent meeting.

H. C. Goldrick, Pacific Coast manager Kellogg Switchboard & Supply Company, is making a business trip in the Northwest and will be away from San Francisco for about two weeks.

F. L. Webster of the Allis-Chalmers Manufacturing Company, San Francisco, has left for an extended trip throughout Eastern cities and will visit the factory of his company at Milwaukee.

R. St. John, formerly sales agent with the General Electric Company at San Francisco, is now representative of the Edison Lamp Works of General Electric Company at Los Angeles, Cal.

Morris Wenk had conferred upon him the degree of Electrical Engineer at the commencement exercises at Stanford University, California, this week. His thesis was "A Study of the Repulsion Motor."

F. N. Kollock Jr., until recently district manager for the Westinghouse Electric & Manufacturing Company at Seattle, Wash., has been made treasurer of the Westinghouse Lamp Company, with office in New York City.

T. B. Culhane and **J. Sandberg** of the sales department of the General Electric Company, have returned to Salt Lake City after a three weeks' trip through Idaho and northern Utah, where they have been on business for their company.

C. B. Kennedy, previously at the Lake Buntzen plant of the B. C. Electric Railway Company, Ltd., was at San Francisco last week, having stopped off en route to Bishop, Cal., where he has accepted a position with the Nevada-California Power Company.

General Irving Hale, formerly in charge of the Denver office of the General Electric Company, is a visitor in Salt Lake City over Sunday. General Hale has been in poor health for the past three years, and this trip is principally for the purpose of exchanging greetings with the men in the various offices formerly under his direction.

H. A. Lardner, Pacific Coast manager for J. G. White & Company, has left San Francisco for an extended stay at New York City. Mr. Lardner is also chairman of the committee on Pacific Coast relations for the International Electrical Congress at San Francisco in 1915 and plans to start active work at San Francisco on his return from New York.

A. H. Boyd, who has been with the Fort Wayne Electric Works since 1898, during the last four years of which time he was manager of the Philadelphia office, has resigned in order to accept the position of general manager and treasurer of the reorganized Santo Manufacturing Company. The new concern expect to continue the manufacture of the complete line of Santo Cleaners.

MEETING NOTICES.

Utah Society of Engineers.

The regular monthly meeting was held Friday evening, May 15th, at the Consolidated Music Hall. S. E. Park, engineer of the Utah Gas & Coke Company of Salt Lake City, read the principal paper of the evening on the subject, "Coal Gas Production."

Portland Section A. I. E. E.

The annual banquet and election of officers will take place at the Blue Room, Multnomah Hotel, Portland, Oregon, on June 2d, 1914, at 6:30 p. m. Reservations must be in the hands of the committee, L. R. Elder and L. T. Merwin, on or before May 28th. A good time and successful meeting is anticipated.

California State Association of Electrical Contractors.

Past successful picnics assure the success of the next annual picnic of this association to be given by San Francisco Local No. 1 for the benefit of the 1915 Convention Fund on Saturday, June 6, 1914, at Monticello Grove. The trip will be made by boat and dancing aboard is the order, as well as at the grove. All who can are urged to co-operate with the electrical contractors in making this picnic a huge success. Further particulars may be secured from W. S. Hanbridge, secretary Rialto Building, San Francisco.

San Francisco Electrical Development and Jovian League.

At the regular league meeting resolutions were adopted placing the league on record as favoring the provisions of the Stevens Bill which was so ably discussed at the previous meeting; and in favor of M. J. Sullivan as appointee for the office of city electrician which is now vacant. The meeting was then turned over to C. C. Hillis, chairman of the day who introduced J. G. Decatur of the Western Union Telegraph Company, who gave an address on the transmission of intelligence referring to the early and comparatively crude methods of signalling and tracing development up to the present day effectiveness of the telegraph. There was a representative attendance and the address was thoroughly enjoyed by all present.

The Jovian Electrical League of Southern California.

About 120 Jovians attended the weekly luncheon at Christopher's, Los Angeles, on Wednesday, May 13th, to listen to an illustrated talk on "The Instruments and Results Obtained at the Solar Observatory, Mt. Wilson," by Prof. Ferdinand Ellerman of the Mt. Wilson staff. The lecturer gave a vivid description of the many electrical and astronomical instruments in use at the station, mentioning in passing that 57 electric motors are in use for various operations. Many beautiful cloud and scenic effects were shown by means of

slides and the talk of the professor was as interesting as it was instructive.

The luncheon was presided over by H. L. Miller and a splendid musical program was rendered.

Utah Electric Club.

At the regular luncheon held at the Commercial Club Thursday, May 14th, Stephen H. Love, president of the Commercial Club Traffic Bureau of Salt Lake City delivered an address on the subject, "The Regulation of Public Utilities." Mr. Love has led the fight for the reduction of freight rates to the intermountain territory before the interstate commercial commission, and has acquired a most intimate knowledge of the elements of this important subject. The special committee on arrangements for the club's first summer outing to be given at Lehi, the trip to be made there over the new interurban electric line Saturday, May 16th, reported that all the details for the trip had been arranged, and that a most successful day was assured.

Annual Meeting Pacific States Electric Company.

The annual meeting of the district sales managers of the Pacific States Electric Company will be held at Los Angeles during the week May 25th to 30th. The meeting will be attended by W. L. Goodwin, general sales manager; D. E. Harris, district sales manager, San Francisco; Geo. A. Boring, district sales manager, Portland; E. A. Norton, district sales manager, Seattle; Ross Gilson, district manager, Oakland; F. J. Airey, district sales manager, Los Angeles; C. H. Carter, district manager, Los Angeles.

On completion of their meetings they will be joined by President H. V. Carter, and all will attend the Jobbers' Convention to be held at Coronado during the latter part of the month. The northern representatives will be accompanied by P. B. Hyde of the Thomas A. Edison Company. They will make the trip to Los Angeles via steamer.

MONSTER LOS ANGELES JOVIAN REJUVENATION.

The second rejuvenation of the present administration was held at the new Clark Hotel on Hill street on Friday evening, May 15th. Before the 100 Jovians and 60 candidates entered the banquet hall, general handshaking and good fellowship prevailed among those assembled in the beautifully appointed parlors. During the feast, a splendid cabaret show was presented, the same having been arranged for by Stentors Pieper and Morphy and the entire assemblage joined in the singing of popular airs, copies of which had been distributed among the diners. Statesman Colkitt then introduced Secretary Van Kuren as toastmaster, who in turn thanked the Stentors for their efficient services. These worthy gentlemen responded most happily by springing each other's stag stories on the unsuspecting and still uninitiated neophites, and then R. H. Ballard, secretary of the Southern California Edison Company, a candidate, responded to the toast, "Does it Pay to Become a Jovian?" He remarked that in view of the fact that this fine spread was given gratis to the candidates, it does pay to become a Jovian and spoke encouragingly of the esprit de corps among the electrical fraternity of Los Angeles, referring jokingly to the recent power bond election. He was followed by Max Loewenthal, who spoke in a serious vein on "Co-operation." He referred particularly to the need of merchandizing co-operation, especially the maintenance of prices and quoted from speeches on Co-operation by Jovians Crouse, Watts and others. He referred to the aid to be expected by the industry from the Society of Electrical Development and the need of a Pacific Coast branch of the society. He launched a plan for an electrical exposition in Los Angeles, directly after the close of the northern and southern expositions. affording the exhibitors at these places an opportunity to send their exhibits to Los Angeles before they are returned to the East. The 60 candidates were then taken in hand by the degree team consisting of the following:

J. G. Pomeroy, 820—Jupiter.
R. S. Clapp, 2000—Neptune.
Theo. E. Burger, 2624—Pluto.
L. E. Darrow, 10727—Vulcan.
D. H. Conover, 10725—Mercury.
H. L. Miller, 7405—Hercules.
J. C. Rendler, 7320—Mars.
G. E. Arbogast, 7376—Apollo.
S. T. Snow, 10774—Avrenim.

The "victims" were led throughout the lobby, street and kitchen, finally being conducted into the presence of Jupiter, whose throne had been erected in the specially appointed grill room. The services were impressive and well conducted and reflected much credit on the team.

The rejuvenation was, without exception, the most successful in the history of Southern California Jovianism and this was due largely to the untiring efforts of Statesman Colkitt. The first prizes for securing the largest number of candidates was divided between A. G. Drake and J. E. MacDonald, the prize for each being a Jovian ring. The former secured 17 and the latter 16 members. The second prize, a pair of Jovian cuff buttons, was awarded to Jas. Irvine, J. H. Pieper, who deserved second prize, being an officer, did not receive the same.

Among the candidates, a list of which follows, were 14 from the local Edison Company, 5 from the Pacific Telephone & Telegraph Company, 5 from the Riverside municipal plant.

Newly Initiated Jovians.

George Edgar Armstrong, Southern California Edison Co.
James V. Alexander, Southern California Edison Co.
Frank M. Balfour, Southern California Edison Co.
Knight Taylor Bennett, Western Construction Co.
George Wilson Barker, Standard Carbon Co.
Russell H. Ballard, Southern California Edison Co.
George Herbert Cederlof, John A. Roebling's Sons Co. of Cal.
James Hughes Cannon, Southern California Electric Co.
Thomas James Callaway, Towne-Lantz Electric Co.
Frank Mathews Coker, The Dean Electric Co.
Elmer Cutting, City Riverside Elect. Dept.
Joseph H. Cox, City Riverside Elect. Dept.
Irving Fisher Dix, Pacific Tel. & Tel. Co.
Lewis Degen.
Walter K. Farra, Greenwood Advertising Co.
Frederick F. Foster.
Walter L. Frost, Southern California Edison Co.
Herbert Bennett Fletcher, Southern California Edison Co.
William Lornax Graves Jr., Southern California Edison Co.
William John Gracer, Pacific Light & Power Corp.
Edmund Hatcher Granger, Granger-Hall Electric Co.
William H. Crumwald, Southern Sierras Power Co.
William Francis Gibbs, Western Electric Co.
John Francis Heath, Independent Elect. Supply Co.
Oliver Richard Hess, Pacific Tel. & Tel. Co.
Samuel Caldwell Haver Jr., Southern California Edison Co.
Edward Irvine, Independent Elec. Supply Co.
Edwin Aubrie Irish, Pacific Tel. & Tel. Co.
James Charles Jenkins, B. F. Kierulff Jr. & Co.
Robert William Jamison, Bell & Jamison.
Jacob Howard Leeds, General Electric Co.
Geo. E. Le Gassick, Woodill & Huise Elect. Co.
John W. MacMillan Mfgrs. Agent and Mdse. Broker.
Frank Emerson McKeever, Western Electric Co.
Charles Franklin F. McDonald, Western Construction Co.
Frank Thomas Maeesen, Pacific Light & Power Corp.
Charles Frederick Mason, Pacific Tel. & Tel. Co.
Harry Jack Moulton, Southern California Edison Co.
Roy Archibald Morehead, Pacific Tel. & Tel. Co.
Donald Riley Paramore, Southern California Edison Co.
Arthur Clair Putman Joint Pole Committee.
Charles Arthur Rowley, City Los Angeles Dept. Pub. Util.
William Rishebarger, Woodill & Huise Elect. Co.
George Fred Roberts, J. E. Wilson Elect. Co.
Thomas Arthur Spencer, Gen. Delivery.
Z. Howard Sherart, Southern California Edison Co.
Marshall David Sedam, Pacific Tel. & Tel. Co.
John Thompson Shannon, Beardsley Electric Co.
Henry Noteware Sessions, Southern California Edison Co.
I. Rosh Solomon, Gould Storage Battery Co.
Harry Elmer Stinchfield, City of Riverside.
Frank A. Short, City of Riverside.
Arthur Clayton Turner, City of Riverside Elec. Dept.
Frank Henry Trimble, Elect. Lighting Supply Co.
Eugene Lancaster Trowbridge, Westinghouse Elec.&Mfg.Co.
W. W. Van Deusen, W. W. Van Deusen Co.
Greenleaf Moores Woodbury.
Robt. Garfield Wagner, Wagner-Woodruff Co.
Walter F. Westbroot, Southern California Edison Co.
Arthur G. Yone, Southern California Edison Co.

RAILROAD COMMISSION OF OREGON.

As a result of an informal investigation on the initiative of the Commission into the matter of standards for maintenance of underground conduits, manholes, etc., a pamphlet of rules and practices recommended to utilities in Oregon in regard to protection to be afforded at manholes has been issued by the Commission. These rules are believed to be somewhat novel, and are a result of conferences with representatives of utilities following a manhole accident in Portland, this accident causing suspension of telephone, fire alarm and burglar alarm service in a considerable territory, for many hours.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The Railroad Commission has rendered a decision authorizing the Southern California Gas Company to issue $325,000 par value of its preferred stock and sell the same to N. W. Halsey & Co. This is a part of a $750,000 issue, which had previously been authorized, but which had not all been sold within the time prescribed by the original order of the Commission.

The Southern Counties Gas Company of California has filed an application with the Commission asking authority to cancel an escrow agreement with the Los Angeles Trust and Savings Bank dated March 9, 1911, under the terms of which 5000 shares of the 6 per cent cumulative preferred stock of the company was to be issued and registered by the bank. Under the agreement, there has been issued 3400 shares at the par value of $340,000 and there are unissued 1600 shares. The owners of the issued preferred stock and the officers of the bank have agreed that the authority of the commission under the terms of the public utility act over all issues of public utility stock is sufficient to safeguard their investment.

The commission has rendered a decision authorizing the Downey Light, Power & Water Company to sell its electric system in Los Angeles county to the Southern California Edison Company for $50,938.30. The selling company has been exacting a rate of 15 cents per kw.-hr. for lighting purposes, and 6 2/3 cents per kw.-hr. for power purposes. The Southern California Edison Company will reduce the rate for lighting purposes on a sliding scale of from 7 cents per kw.-hr. to 2½ cents per kw.-hr, and for power purposes on a scale of from 6 cents per kw.-hr. to 1½ cents per kw.-hr.

UTAH STATE BOARD OF EQUALIZATION.

The Board has valuated the properties of public utility companies in Utah, based upon the assessment made on January 1st of this year. The valuation of the principal public utilities are compiled as follows:

Interurban Railways—	
Salt Lake and Ogden	$ 564,650.00
Ogden Rapid Transit Co.	241,225.00
Salt Lake and Utah R. R. Co.	240,575.00
Total	$1,046,450.00
Lighting and Power Companies—	
Utah Light and Railway Co.	$3,267,580.00
Utah Power and Light Co.	2,405,925.00
L. L. Nunn Properties	55,415.00
Beaver River Power Co.	100,275.00
Total	$5,929,195.00

EXAMINATION FOR EXPERT RADIO AID (MALE).

The United States Civil Service Commission announces an open competitive examination for expert radio aid, for men only, on June 17, 1914, The duties of position will be as follows: To direct and assist in the laboratory standardization tests of all circuits, instruments, and apparatus pertaining to and used in radio signaling; the practical installation, repair, and adjustment of radio apparatus both in shore stations and on ships; the development of special apparatus and methods of radio signaling suited to special conditions, and of new forms of sending and receiving circuits; to inspect the various radio stations when called upon and to make the necessary measurements of their electrical constants; and, in general, to carry out such work as may be necessary for the development of radio apparatus. They will be required to prepare technical reports of inspections, tests, and experimental research work. It is further desirable that they should be operators, but this not necessary. A rating of at least 70 per cent in the subject of training and experience is a prerequisite for consideration for this position. Age, 21 years or over on the date of examination. Persons who meet the requirements and desire this examination should at once apply to the United States Civil Service Commission, Washington, D. C., or to the Secretary of the United States Civil Service Board for application Form 1312, stating the name of the examination for which the form is desired.

NEW CATALOGUES.

The American Blower Company has issued Bulletin 35, Series 1 describing the use of the Pitot Tube for fan testing. Much valuable data and a number of test charts are given.

Laboratory Ozone Apparatus is the title of an eight page booklet issued by the Sprague Works of General Electric Company. Ozone mixers, air filters and industrial ozonators are also illustrated and described.

Bulletin No. 41010 of the Sprague Works of General Electric Company, illustrates and describes in detail that company's make of d.c. motors, Types C and D. A number of illustrations showing the application of these motors, is also given.

Standard Underground Cable Company, Pittsburg, Pa., has just issued bulletin No. 200-1 giving specifications for Standard C. C. C. (Colonial Copper Clad) wire, hard drawn, bare, 30 per cent grade. New Bulletin No. 400-1 of the same company deals with weatherproof insulated wires and cables, solid and stranded, double and triple braid.

Fairbanks-Morse d.c. type "CP" motors and generators are described in bulletin No. 27 and type "TRL" in bulletin No. 29 just issued by that company. Type "B" constant speed induction motors, horizontal and vertical, together with starters for same and complete data is given in bulletin No. 202H, while No. 210 gives full information regarding Fairbanks-Morse internal starter motors. The manufacture and construction is also fully described in each case. The bulletins may be obtained by addressing the nearest office of the company.

The Westinghouse Electric & Manufacturing Company has recently issued a number of publications dealing with the different lines of apparatus manufactured by that company. Among these are Section 3082, Motor-Driven Pumps. This publication has an attractive art cover, and is profusely illustrated with views of installations of pumps of various kinds and performing duties of a varied nature. Table are given showing the frictional heat in wrought iron pipe, horsepower for pumping, standard dimensions of pipe, and atmospheric pressures, equivalent heads and suction lifts. Ironing, a Pleasure, Folder 4281 describes the household and travelers iron manufactured by the company. On the front page is a picture of the cutout representing "Dorothy" ironing. This device is furnished dealers and central stations by the Westinghouse Electric Company for use in their campaigns. Westinghouse 56 in. d.c. Ceiling and Column Fans are described and illustrated in Folder 4282. The KD Battery Charging Panels for Two-Wire Systems, 50 to 250 volts. Leaflet 3719 describes and illustrates the panels for systems above mentioned for lighting and electric vehicle charging. Typical diagrams of connections are shown.

PUBLICATIONS RECEIVED.

"Determination of Ammonia in Illuminating Gas," is the subject of Bureau of Standards, Technologic Paper No. 34, by J. D. Edwards. Experimental results obtained in the course of a brief investigation of the apparatus and methods employed are presented. Five forms of apparatus have been studied and their relative accuracy determined. Suitable indicators have been recommended and precautions to be observed in the operation of the different forms of apparatus have been pointed out. Copies of this paper may be had upon application to the Bureau of Standards.

ELECTRICAL CONTRACTORS' DEPARTMENT

COST-KEEPING APPLIED TO ELECTRICAL CONTRACTING.

BY E. H. WEST.

(The author outlines the purpose of cost keeping, its objects and possible economies; differentiates between it and bookkeeping and outlines the essentials of a system at once simple though satisfactory for the electrical contracting business. The paper was presented by Mr. West, who is efficiency engineer, Portland Railway, Light & Power Company at a recent meeting of the Northwestern Electrical Contractors' Association.—The Editors.)

It might be well to outline the purposes and objects of cost-keeping. There are two primary objects. The first is to enable the proprietor or manager of a plant or industry to analyze his costs with a view of securing the most efficient and economical result from the work under his direction or supervision; second, to enable him to provide a record that he can refer to in making up estimates of the probable cost of work in view. In making up his analysis of costs, as outlined under the first condition, according to Gillette he naturally looks for the following:

First—Excessive use of material.
Second—Lost time or unoccupied time of the workmen.
Third—The excessive use of small supplies.
Fourth—The efficiency of the foreman, or the man in charge of the work for him.
Fifth—The padding of pay rolls.
Sixth—The improper planning or routing of jobs.

The second primary object, as stated above, necessitates a clear-cut office system that will enable foremen or others who make up estimates to get complete data quickly. Bookkeeping and cost-keeping are two separate and distinct functions. It is true that the bookkeeper can be used in keeping cost accounts, or the cost accountant can get out a balance sheet, but the functions of the two classes of work are distinctly different.

First—The bookkeeper's work ends when he has turned out the final balance sheet. He shows the financial status of the firm. If it is losing company, he shows it. He does not show where it is losing money, or how it is losing money, but simply that it is losing money. The cost accountant, on the other hand, using the same figures that the bookkeeper has used, makes up, in tabular form, comparative statements of costs, showing what similar work has cost on various jobs, showing the reason for the costs going up on certain jobs and by the very fact of his doing so enables the manager or proprietor to devise methods to produce desired efficiencies. Bookkeeping has been termed "the process of recording commercial transactions for the purpose of showing debits and credits between accounts." These accounts may be individuals or firms, or they may be arbitrary accounts. The latter being an evolution in bookkeeping after individual accounts became so large or so complicated as to be insufficient to show the status of the business and the profits derived from any given transaction. Cost-keeping, on the other hand, is the process of recording the number of units of work and the number of units of material entering into the production of any given structure or into the performance of any given operation. To these units of work or material actual or arbitrary wages or prices may or may not be assigned.

The object of cost-keeping is primarily to show the efficiency of performance, hence actual money disbursements need not be recorded as in bookkeeping. This distinction is vital, and will be discussed at greater length.

The previous statement may seem inconsistent with some of my former remarks. Inasmuch as I stated that the object of cost-keeping is primarily to show the efficiency of performance, hence actual money disbursements need not always be recorded as in bookkeeping. I make this statement advisedly, although we invariably consider the necessities and operations of life in terms of dollars and cents.

Actual money disbursements need not always be recorded, for in the working out of costs of doing work a $5.00 man may do as much of the same kind of work, in exactly the same time as a $2.00 man could do it. Therefore, the matter resolves itself into a study of hours and minutes in the case of labor, and into units of weight, length, or pieces in the case of materials. Many contractors combine cost-keeping and bookkeeping and make an attempt many times to have a cost-keeping system so elaborate that it will be the bookkeeping system, too. Doing this, you are burdening the bookkeeping with a great deal of material that does not belong to it and piling up, or increasing your cost-keeping expense under an avalanche of details that are destructive to the value you are attempting to secure from your cost-keeping records.

Bookkeeping records are usually a month to month proposition; cost-keeping records show a daily result and the manner in which the work has been conducted on a particular job. The books close at the end of the month, and the consumer or customer is billed with the contract price of the job, or the cost on a labor and material basis. If the latter, the contractor is reasonably sure of a profit, providing he has taken into consideration that intangible and fickle item—overhead expense or burden.

Cost-keeping, when conducted properly, tells you day by day the progress of the work on a job, its cost as compared with its estimated or allowed cost, and just what, if conducted properly, will be necessary in order to complete the work within the prescribed limits of time and money.

The bookkeeper makes no mention or pays no attention to the matter of job costs until same is completed; neither is he interested in weather conditions or distances; the cost-keeping accountant and estimators must take those things into consideration.

With cost-keeping records, sketches and plans of work performed are an essential part, and such things, if added to the bookkeeping record, would only confuse them.

I think I have satisfactorily outlined the differences between cost-keeping and bookkeeping.

In connection with your cost-keeping work, it is necessary to have several allied systems of records—first, a balance of stores system; in other words, a system that will keep track of all of the available material that goes into each job, the amounts on hand for the job, and the time at which material should arrive in order to complete the job efficiently and economically. How many times have you started out to do work with only half of the material available, and found it necessary to send a high-priced workman to the supply house to secure the balance of the material needed, or had to quit work on a job because you were waiting for material to arrive, where if you had properly planned out your work in the first place, secured or had available all of the material and had it ready for the job when you were ready for it, a considerable amount of time could have been saved with a monetary saving to you. As important to keeping your stock listed and properly balanced is the matter of time-keeping. Ordinarily time is charged to a job number and turned into the bookkeeper, and so long as the total number of hours worked checks with the foreman's report, the man is reasonably sure of securing his weekly or monthly wage.

Time-keeping can be simple or complex. When the light and power department of the P. R. L. & P. Co. had its time-keeping done by the bookkeeping department, three men were required to take care of it. When the time-keeping was put under the cost-keeping system, one man took care of, and still takes care of, the entire matter. There are many ways of recording time, from the simple system of a foreman's note book to the more elaborate one of having a card for every

operation performed which involves the use of some form of special time-calculating device.

The Cost Chart (Fig. 1) illustrates the manner in which expenses get into total cost. To institute such a system is not a complicated matter, nor does it require any elaborate bookkeeping or cost-keeping force. By having a proper system of time cards, material requisitions and cartage slips, the direct expense item of total costs is not difficult to obtain; but the burden expense (that bug-a-bear of indus-

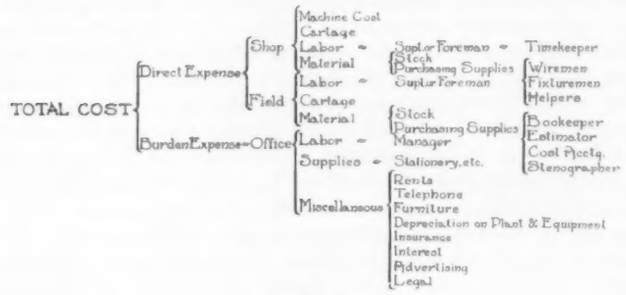


Fig. 1.

trial commercialism, which because of its very nature and existence is a burden) is not so easy to apportion. Hardly any two people agree in the manner in which it should be taken care of. However, for the purpose of your work some uniform scheme should be adopted and adhered to. I strongly condemn the standard practice of apportioning total burden costs on a percentage basis to the total cost of material and labor. I would apportion "burden labor" and supplies on the basis of labor hours to a job, and the miscellaneous expense on the basis of total direct cost. The first, because burden labor is principally necessary in order to supervise and take care of the direct labor employed on the job and to see that such labor performs its work economically as regards time and material. You say, "What about the direct supervision? Is not that supposed to supervise the direct labor?" The answer is most decidedly "Yes," but only as regards proper and correct work; seeing that the proper kind of workmen are used, that each operation is done in its turn and that the proper material and tools are on the job to work with. The purchase and shipping to the job of the tools and material is up to the office, and the getting of the job done in time is also up to the manager or proprietor (in the case of small concerns where the proprietor is the manager).

A cost-keeping system fits in and is just as important to your line of work as it is to any other. Your business is not so different that the value of cost-keeping can be overlooked or disregarded. The elaborateness of the system, however, can, and does often, overwhelm the person attempting to put it in.

First, because many (so-called) experts have cropped up all over the country with systems of card records and loose-leaf ledgers that have plunged small organizations in a mass of worthless detail.

In scientific management the term "production engineering and cost and planning department" are often heard. You can have a cost and planning department in your own organization (see Fig. 2). The proprietor or manager of a small concern can be the production engineer, or planning engineer. Some one man of your organization can be delegated the task of material and tool man; the bookkeeper himself can take care of the job cost records; the production man can each day lay out in advance the work that each one of his crew is to do the next day, basing the task assigned on his own intimate knowledge of what it is possible to do. In order that he may be able to do this intelligently, he should work by means of sketches, rough—overall dimension sketches are enough in addition to his knowledge of the particular ground he is to cover. By having material estimate sheets, similar to the one I am showing you here (Fig. 3), it will be possible for the planning man to lay out the operations of the work to be performed together with detailed lists of material. This he can turn over to his material man to have filled. By going over the jobs on hand the exact time in which the last job that came in can be done is readily determinable. The cost-keeping work can be taken care of day by day by the bookkeeper, who will enter up on his copy of the estimate the material

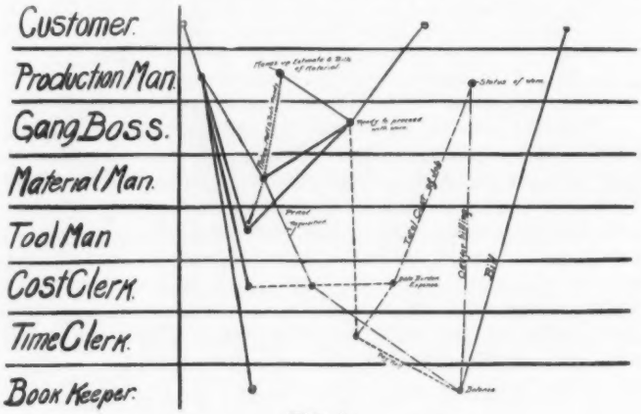


Fig. 2.

and labor costs that have come in, and will note exactly how the job stands. It will be his duty to notify the manager or the production man of the status of the work, and as soon as the estimated expenditure is about reached, he should have the production man go over the work with him to see where changes or adjustments in the working schedule can be made that will keep the total expenditure somewhere near the estimated amount.

The production man will receive all jobs arriving in the shop; he will number them, and it is his duty to issue the instructions to the cost clerk and the material man. He should make up the material list, tool assignment and job instruction cards or estimates. He should designate the particular sequence of operations on each job, and the exact route and order each operation of the job must take. From his knowledge of his force he should assign the workmen to each operation and task shown. All of the information concerning the work going on in his business should be shown on a large sheet or blackboard, which we will call for con-

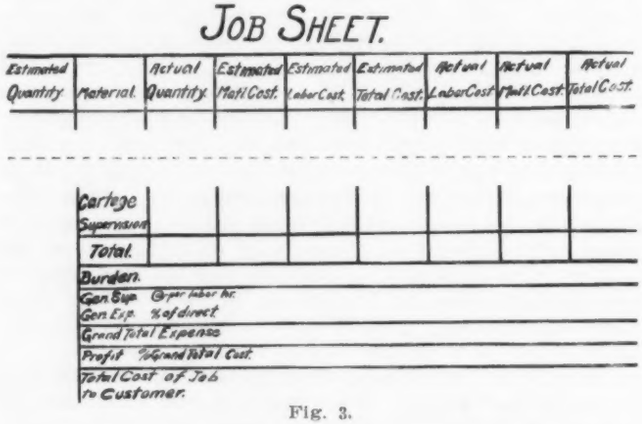


Fig. 3.

venience a dispatching record. Its purpose is to show the work projected and under way. It will be his daily record of the status of each job. He will note on it the time in which the job should be completed, and he can tell as he goes over the record each day just how each job stands. Of course, many of you will say right away that you have been doing this for a long time. You have not had the elaborate records,

etc., that I am talking about, because you have carried it all in your head, and that is just the very point I want to bring out.

The difference between scientific management and rule of thumb methods is largely the difference between careful, systematic recording of operations and events and attempting to carry in the head the same operations and events, which cannot be done unless you have only one small job under way.

Another function of costs and planning is that of the time clerk. In a small organization the bookkeeper and the production man naturally take care of the time. For convenience a small rack should be made to hold the cards for each workman. There should be two spaces assigned each workman — one for the finished work and one for the work under way, or to be done. After he has performed the particular task assigned to him, he should turn in the time card and receive or take from his rack the card for the next work that is to be done. From these cards, both for his productive and non-productive time, which should all be taken care of, the bookkeeper will make up the payrolls, or pay checks, and will enter the time against the jobs worked on the job sheets themselves. It is not expected that I can tell you exactly how your cost-keeping work should be conducted for the very reason that conditions vary. What might apply to one shop will not apply to another, but the fundamental principles involved have been applied to millinery establishments with just the same success that they have been applied to large iron and steel industries.

Planning, routing work and cost-keeping have also been carried out along the lines just mentioned in boat-building establishments and sawmills. The Yale & Towne factory in Connecticut, that manufactures all of the Yale locks, and the Link Belt Manufacturing Company, in Philadelphia, are two of the best examples of plants operated under the Taylor System of Scientific Management.

A progress cost curve that is very easy to make and keep up for each job under way should be used. On it you will require the cost man to make the necessary extensions daily, and by being sure that your manager or proprietor initials same every night, there is no excuse for your not knowing just what the status of each job is.

TRADE NOTES.

The Mohrlite Company has secured the lighting fixture order for the Orient Building, Pine street, San Francisco. The equipment includes 56 Mohrlite indirect units.

The Telephone Electric Equipment Company, San Francisco, has succeeded Jno. R. Cole, who resigned as agent for Harvey Hubbell, Inc., of Bridgeport, Conn.

Plans have been completed for the erection of a new engineering building to cost $200,000 at the University of Southern California. The building will occupy 150 feet frontage on the present site of the engineering and chemistry buildings.

The Santo Manufacturing Company, Philadelphia, Pa., announces the purchase of the patents and manufacturing facilities of the Keller Manufacturing Company and will continue to manufacture and market the well known Santo Vacuum Cleaners. The business will be conducted under entire new management, but the same engineering and manufacturing organization have been retained, thus insuring the same high quality of product as heretofore.

The last gap in the Northwestern Pacific railway from San Francisco to Eureka, Cal., has been reduced to seventy miles, being covered in auto stage. A daily schedule of daylight service has been established so that it is now possible to make this trip in 26 hours, including one night stopover at Fort Seward. This road is of peculiar interest to the engineers because of its electrification possibilities by means of abundant water power in the region traversed and because of its rich lumber resources.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell Secretary-Treasurer, 55 Fulton, San Francisco

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

The C. A. E. I. held its May session in the council chambers, city hall, Berkeley, and were the guests of City Electrician W. E. Brothers. The topic for the session was "Wiring and Equipment of Meter Locations."

The National Code contains no especial provisions which govern the wiring and equipment of meter locations, except that the main service switch and cutout must be arranged to cutoff the current from all devices, including meters; but the general provisions for protecting wires by fuses and for the mechanical arrangement of wires and devices apply. The methods used in the several districts appear to be somewhat different but a tendency to group all meters for each building in one location was reported. The easiest way to treat the subject seems to detail the best defined systems separately.

Rigid Conduit and Metal Troughing System Method: All wires must be enclosed in a wire way of rigid conduit or metal troughing, except as otherwise herein provided. The completed wire way must enter each cabinet which it adjoins with a bonded and bushed joint; must be grounded, and be large enough to easily contain all the wires.

Switches and Cutouts: All switches and cutouts must be enclosed in one or more metal cabinets; all cutouts grouped as far as practicable. All cutouts may be and all service cutouts must be in a single group.

Metal Troughing must be of galvanized metal at least No. 24 V. S. gauge in thickness (equivalent to No. 22 B. & S. gauge) and must consist of a base and a cap each made in one piece. The base must form three sides of the enclosure and the cap shall include grooves made to confine the edges of the base so as to form slip joints. Holes, spaced 12 in. for No. 10 standard machine screws equipped with nuts, must be placed in each sliplock joint. The completed troughing must form a bonded wire way free from projecting edges, burs or fins.

Wires: Wires may project from the wire way and be exposed for 12 in. for meter connections but a separate hole of proportionate size equipped with an insulating bushing designed for the purpose must be provided for each projecting wire. No wire shall project through the cap of any metal troughing. Each wire must be in one continuous length from cabinet to meter, from meter to cabinet, or from cabinet to cabinet, as the case may be, and no splice tap or connection shall be made in or to any wire in the wire way.

[To be continued.]

PLAY BA—A—A—LL.

The Rock Ridge Amateur Baseball League, containing eight very fast semi-pro teams, started their last winter's schedule on October 26th, played a series of twenty-one games, of which the team representing the Great Western Power Company landed the pennant offered by A. G. Spaulding & Company and the silver cup given to encourage clean amateur baseball by the Fred E. Reed Company, Syndicate building, Oakland, Cal.

INDUSTRIAL

THE TITAN STORAGE BATTERY COMPANY.

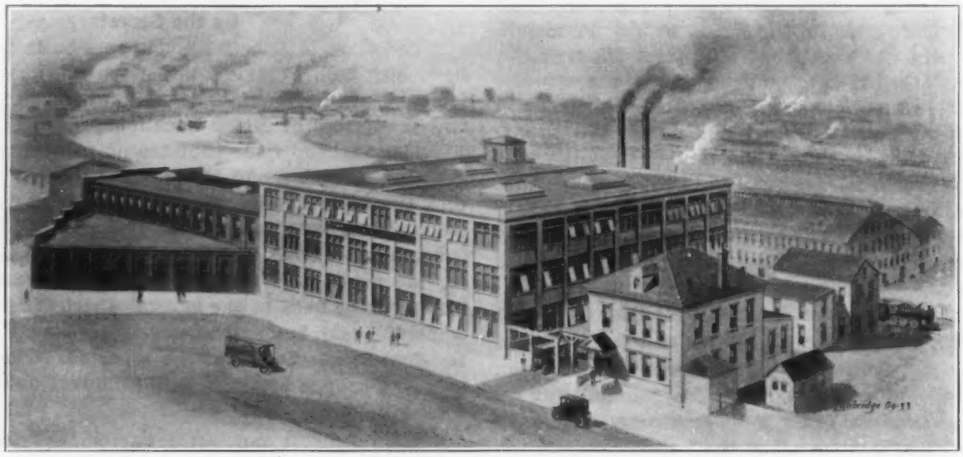
An important event in the storage battery industry has taken place. We refer to the change in the name and the location of the company which has heretofore done business as the Baltimore Electric Storage Battery Company with factory and offices in Baltimore.

Henceforth the company will be known as the Titan Storage Battery Company Extensive new quarters have been secured in Newark, N. J., at Chapel street and Lister avenue, at which point the offices of the company have been established for some time and the manufacturing equipment is now in operation so that the Titan vehicle batteries, Plante batteries, lighting and sparking batteries, and "self-starter" batteries are being shipped from the new location."

The removal was brought about by the necessity for increased facilities and the fact that the Newark location possesses advantages over what could be procured in Baltimore. The change in name is a move in the direction of simplification and is made possible through the fact that it is no longer desirable to identify the company name with the location.

The officers of the Titan Storage Battery Company are as follows: Henry M. Keith, president; Daniel C. Spruance, vice-president; Edward S. Hyde, treasurer; Henry H. Hanson, secretary. These gentlemen, with Minor C. Keith and John G. Gray, constitute the board of directors. Dr. W. E. Winship is general manager, A. H. Mustard is sales manager, and Eugene Handler is superintendent. No change in the policy of the former company, beyond that of enlargement and expansion of operations, is indicated by the change in name and location.

The control continues in the hands of Minor C. Keith, vice president of the United Fruit Company and president of the International Railways of Central America.



General View of Titan Storage Battery Plant.

SWITCHBOARD AMMETERS AND VOLTMETERS.

A new line of 5 in. d.c. indicating ammeters and voltmeters, known as the type FW, and suitable for small isolated plants, yachts, battery-charging panels, etc., where a high grade low price polarized instrument is required, has just been placed on the market.

The meters operate on the D'Arsonval principle, having a moving coil and a permanent magnet, and possess many points of superiority to the cheaper types of construction usually found in low priced meters.

The complete movement is mounted in the case as a unit. A unique feature is the arrangement of the moving element, which can be taken from the movement by simply removing two screws on the side of the pole piece support. The entire moving element and bearings can then be lifted out as a unit and can be replaced in exact position. This makes it possible to repair the meter without disturbing the alignment of the magnetic circuit.

Owing to the use of an aluminum pointer, a light counter weight is possible, resulting in a light weight of movement and small wear on the pivot jewels. The high torque, in proportion to the light weight, insures great accuracy considering their size.

Their scales are 4 in. long., which is practically the same length as the scales of many 7 in. meters. The full length of the pointer shows on the dial, thus making the meter as easy to read as a clock. The movement is thoroughly damped to secure dead beat readings. These meters are manufactured by the Westinghouse Electric & Manufacturing Company.

View of Meter With Dial Removed.

Although somewhat diminutive in size they are not in any sense competitive with many "toy" meters on the market but are designed along strictly scientific lines and possess a high grade of quality.

NEWS NOTES

FINANCIAL.

SAN FRANCISCO, CAL.—The directors of the Northern California Power Company have voted to submit to stockholders a proposal to authorize $2,000,000 6 per cent cumulative preferred stock, of which only $500,000 will be issued at this time. A meeting of the stockholders has been called for July 17th to vote on the question.

LOS ANGELES, CAL.—The plan of procedure for acquirement of money on the recently voted power bonds has been a subject of general discussion. If it becomes necessary the city will endeavor to secure the $1,250,000 necessary to carry on work towards completion of the power plant by purchasing the bonds to this amount with cash from the sinking fund. The question of the validity of the proceedings in the various steps calling the bond election, and the validity of the bonds themselves, has been submitted to the bond experts, Dillon, Thomson & Clay, of New York City. This firm is to receive $1000 regardless of the nature of the opinion, as a retaining fee; $2500 if the opinion for any reason is adverse to the validity of the bonds, or $5000 if the opinion is favorable. Meanwhile the city attorney will be asked to determine whether the board of public works or the public service commission has the power to handle the expenditures, if money is realized on the bond issue..

INCORPORATIONS.

SAN BERNARDINO, CAL.—Plans to develop water and put under cultivation hundreds of acres of land in Pariso valley, near Newberry have been disclosed by the filing of articles of incorporation of the Pariso Valley Land & Irrigation Company, with authorized capital of $800,000. James. O. Parker, Frank P. Apperson, and Frank O. Little are directors.

LAS VEGAS, NEV.—The Colorado River Hydroelectric Company, with a capital stock of $5,000,000, has been formed to construct a dam to develop immense power going to waste in Colorado River. The directors are Wm. Forman, Thomas Lindsey, W. R. Williams, Henry C. Schmidt and M. B. Schmidt, all of Tonopah. Surveys are now under way and construction work will begin this fall. The plant will be located at Boulder canyon, east of Fort Callville.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed of the San Francisco Northern Railway Company. Forty-two miles long, the road is to run from Pt. San Quentin, Marin county, to Santa Rosa, giving Richmond and the rest of the east shore connection by ferry and rail with the north of bay region. Of the capital stock of $2,500,000, in $100 shares, 5000 shares are preferred. The five incorporators and directors have taken $10,000 worth each. They are Allen L. Kittle of Ross, Archibald Borland of Oakland, Frank A. Brush of Santa Rosa, William L. P. Jackson of San Francisco and John C. Kittle of Ross.

ILLUMINATION.

TILLAMOOK, ORE.—The city council has granted a 25 year franchise to the Tillamook Light & Fuel Company.

TACOMA, WASH.—The county commissioners awarded the Vashon Electric Company a franchise to operate an electric light and power plant on Vashon Island.

AUBURN, WASH.—J. L. Veach has been granted authority to construct pipes for the transmission of gas within this city. His company will install a plant to cost about $40,000 or $60,000.

PORTOLA, CAL.—The supervisors of Plumas county have granted a franchise to R. B. Young of Loyalton to construct and operate an electric light system for the town of Portola and vicinity.

FLORENCE, ARIZ.—The city council has instructed the city engineer to investigate what legal steps are necessary for the city to proceed to raise the money and to install a municipal electric lighting plant.

SAUSALITO, CAL.—The Pacific Gas & Electric Company has been granted a franchise to erect electric lines for transmitting electricity in Marin county for light, heat, etc., in Bolinas and in Willow Camp particularly.

COLORADO SPRINGS, COLO.—The city council has under consideration the proposition of installing a municipal electric lighting plant. Bonds in the sum of $150,000 were voted for this purpose in 1907, but no action has been taken up to the present time.

GREEN RIVER, UTAH.—A special election will be called in the near future to vote on the issuance of bonds for the purpose of erecting an electric lighting plant and distribution system. Information in regard to the same may be had by addressing the town clerk.

GLENDIVE, MONT.—Two applications have been filed with the city council for franchises to erect a gas plant and distributing system in this city. One is asked for by F. P. Leiper and the other by E. T. Williams and R. B. Morrison. Both these applications are under advisement by the Council.

NEHALEM, ORE.—Steps have been taken for the purchase of the Nehalem water system and the installation of a municipal electric lighting plant here. The company owning the plant is willing to transfer the plant at a reasonable figure. An election will be held at the earliest possible date, at which time the people will be asked to authorize the issuanec of sufficient bonds for the purchase of the water plant and the construction of a power plant and lines for local service.

ALAMEDA, CAL.—Although the electric light plant is self sustaining the board of electricity has submitted to the council its estimate for the ensuing year. The receipts for 1914-15 are estimated at $176,300, which includes $25,000 for city lighting, but which is not paid from the taxes. The estimated expenses are $112,431.25, which include interest and redemption on all bonds. Besides paying for the city lighting, which is accounted at two and one-quarter cents per kilowatt hour, all extensions, depreciation and bonds are taken care of. It is also estimated that after the year's business there will be a balance of $38,868.75, which will be used as a replacement fund and working capital.

SACRAMENTO, CAL.—Master in Chancery Harry M. Wright has upheld the legality of the 75 cent rate for gas as provided for in the ordinance passed by the supervisors last July, ruling that this rate, which returns 6 per cent on the company's property as valued by the Master in Chancery, is not confiscatory. The Pacific Gas & Electric Company's rate previously was 85 cents and it has been collecting this amount since the ordinance passed through a restraining order issued by Federal Judge Van Fleet. In his findings the Master in Chancery reduced the valuation of the corporation's plant from $19,937,267 claimed by the company to $12,042,590. He refused to allow for rate-fixing purposes the company's franchise, which was estimated at $1,482,641, struck out the "going concern" claim of $2,918,107 and disallowed overhead charges, $625,259; working capital, $401,433; dead mains, $344,651; additions to inventory, $126,478, and obsolete coke ovens $42,840. He also reduced by $1,670,065 the company's estimate of reproduction cost. The decision will not become effective until it is passed upon and signed by U. S. Judge Van Fleet.

TRANSMISSION.

SOUTH BEND, WASH.—Frank Mackean of Seattle manager of the Willapa Power Company, has applied for a franchise to furnish power in Pacific County.

BOISE, IDAHO.—William C. Hazzard of Milwaukee, president of the Clear Lake Power Company, has filed an application to construct and maintain electric transmission and distribution lines in Twin Falls.

SANDPOINT, IDAHO.—Local Manager G. N. Rooker of the Northern Idaho & Montana Power Company, has closed a contract to furnish the Northern Pacific railway division shops with electric power for five years.

LEWISTON, IDAHO.—The council has appointed Emery A. M. Roberts, W. H. Morey, and L. A. Porter to look into the matter of constructing a dam in the Clearwater River for the installation of a municipal power plant. The estimated cost of the project is $500,000.

SAN FRANCISCO, CAL.—Work has been commenced by the Henry Peterson Launch Company laying a new transbay submarine cable for the Great Western Power Company. The work is being done from a 400-ton barge. The cable, which is said to be the heaviest ever manufactured, will extend from the Western Pacific mole on the Alameda shore to the foot of Folsom street. The new line will replace the former cable of the power company which was laid about two years ago.

OGDEN, UTAH.—Extensive damage was done to electrical equipment last week by a severe electric storm which passed over the city from lake to mountains. Portions of the business and residence sections were in darkness for several hours as a result of the burning out of transformers. A bolt of lightning struck the Virginia Hotel, Adams avenue and Twenty-fourth street, burning out the lighting system. The hotel was slightly damaged by the fire which resulted from the lightning. During the storm the entire fire alarm system was put out of commission, and the telephone lines to both fire stations were also burned out. Although the storm was accompanied by a severe rainfall and a brief fall of hail, the resulting damage will not be great.

TRANSPORTATION.

GLOBE, ARIZ.—An election will be held here May 26th, to submit to the voters a franchise for the construction of the Globe-Miami electric railway. If favorably voted on work will begin June 1st.

PHOENIX, ARIZ.—The state corporation commission has issued an order requiring all locomotives used in handling trains in Arizona to be equipped with electric headlights within sixty days from May 15th. The lights to be used shall not be of less than 1000 candlepower.

POMONA, CAL.—The Pacific Electric Railway is making preparations to build a cutoff on the Los Angeles-Pomona Interurban line, from Lordsburg to North Pomona. The proposed cutoff will parallel with the Santa Fe tracks from Lordsburg, and will connect with the Pomona line near La Verne Heights packing house.

VISALIA, CAL.—Frank C. Avery, the promoter of the Big Four Railroad says that negotiations are pending for the sale of the franchise and the completed roadbed of the company to a syndicate of San Francisco capitalists. Negotiations for the sale of the road are in the hands of John R. Hitchcock of Tulare, president of the corporation.

SALT LAKE CITY, UTAH.—General Manager Joseph S. Wells of the Utah Light & Railway Company, announces that the company has decided to give up all their present plans for the extension of its Davis county interurban line to Farmington. The reason for this change of plans is ascribed to the fact that the town council of Farmington has attempted to place restrictions on the company and to require extensive grading and street opening, the cost of which would aggregate $30,000. The company states that it does not feel justified in making the extension under these circumstances.

SAN MATEO, CAL.—The directors of the San Francisco-San Mateo Interurban Right of Way Company, which was organized by the San Mateo County Development Association to build an electric line from San Francisco to Palo Alto, has elected officers as follows: H. C. Tuchsen of Redwood City, president; D. G. Doubleday of Millbrae, vice-president; E. M. Moores of Burlingame, treasurer; F. Eksward, secretary. M. B. Johnson, T. Masterson, F. A. Cunningham and W. A. Brewer are the other directors. The sole object of the directors is to establish an independent railroad down the peninsula.

LOS ANGELES, CAL.—The final draft of the notice of sale for a forty year franchise to contruct and maintain the proposed elevated railway from the Pacific Electric Company's Sixth street depot to San Pedro street, connecting up with the municipal line on that street, has been placed in the hands of the board of public utilities by Assistant City Attorney Howard Robertson. The building of the proposed elevated structure will be the first link in the Pacific Electric Company's proposed elevated scheme which will represent an investment of about $12,000,000. The notice of sale for a franchise covering this first link of the elevated scheme provides for ultimate municipal ownership.

SANTA ROSA, CAL.—F. A. Brush of Santa Rosa, who is a director of the Petaluma & Santa Rosa Railroad Company, is quoted as saying relative to the incorporation of the San Francisco Northern Railway Company: "The new company will control the Petaluma & Santa Rosa road and provide the financial sinews to build extensions and new lines." Eventually, he said, a line would be built from Petaluma south to San Francisco Bay, where he and Borland, Dibblee and the Kittles own a terminus. In the near future a direct line between Petaluma and Santa Rosa will be constructed, to replace the long distance route by way of Sebastopol. Another early probability is a line from Santa Rosa to Healdsburg, 16 miles distant.

STOCKTON, CAL.—Officials of the Central California Traction Company a few days ago made a thorough inspection of the company's city lines with Commissioner of Public Works O'Keefe and all places where improvements were needed were pointed to the railroad men and they promised to improve the road in the very near future. They discussed the possibility of abandoning part of the franchise in order to give better service on the remaining portion, but nothing definite was announced in this regard as the matter must be decided by the board of directors. Messrs. Alden Anderson and M. Fleishhacker, two of the company's officials who made the inspection trip, stated that plans for extensive improvements were under way for the Stockton system and that the matter would be thoroughly threshed out at a meeting of the directors in San Francisco within the next week. The roadbed of the company will be put into first class shape and the street car service will also be bettered.

TELEPHONE AND TELEGRAPH.

HONOLULU, T. H.—Improvements to cost about $40,000 are to be undertaken in a short time in connection with the system of the Hawaii Telephone Company. When completed, probably about December 1st, the island will be belted by metallic circuit trunk lines which will make the country service second to none. Besides this, the city of Hilo is to be relieved of overhead telephone wires, through the installation of underground cables and conduits to replace them. The Mutual Telephone Company, which for some time has been in control of the Hawaii company, is making all these things possible. The Mutual has decided to loan $30,000 of its earnings, which have been set aside to depreciation account, to the Hawaii Telephone Company for these needed improvements. The loan is to be secured by three notes, drawing interest at 6 per cent, each for $10,000, and payable in one, two and three years.